22077 Mound Rd., P.O. Box 1208, Warren, MI 48091-1208 • (313) 758-0400 • U.S. 1-800-347-8622 • Telecopier (313) 758-1129

5/31/90

great lakes environmental services, inc.

SURFACE MATERIAL REMOVAL ACTION PLAN

SITE:

ALBION SHERIDAN TOWNSHIP LANDFILL

ALBION, MICHIGAN

Prepared By:
Great Lakes Environmental Services, Inc.
22077 Mound Road
Warren, MI 48091
phone: (313) 758-0400
fax: (313) 758-1129

22077 Mound Rd., P.O. Box 1208, Warren, MI 48091-1208 • (313) 758-0400 • U.S. 1-800-347-8622 • Telecopier (313) 758-1129

great lakes environmental services, inc.

May 31, 1990

Jason El-Zein
United States Environmental Protection Agency
Region 5
Emergency Response Branch
9311 Grok Road, Room 216
Grosse Isle, MI 48138-1697

Re: Aebion-Sheridan Landfill

Dear Mr. El-Zein:

Enclosed please find the revised work plan for the above-referenced project.

Should you have questions, please contact Ms. Kate Lynnes with Warner, Morcross and Judd.

Sincerely,

Great Lakes Environmental Services, Inc.

Andrea G. Lang

Andrea Lang
Health and Safety Specialist

cc: Beth Henning, USEPA
Thomas P. Shannon, Fox, Carpenter, O'Neill & Shannon, S.C.
Warner, Norcross and Judd
Eagle Picher

TABLE OF CONTENTS

INTRODUCTION

An inactive landfill exists at 13355 29 Mile Road, Albion, Michigan. The Albion Sheridan Township Landfill, which was in operation from 1966 to 1981, accepted municipal and industrial wastes. The site currently is not secured. A variety of surface materials such as demolition debris, storage tanks, 11 empty and 16 full to partially full 55-gallon drums, and some pails ranging from 5 to 15 gallons are on the surface at the site. The U.S. EPA has ordered that action be taken to mitigate possible direct contact hazards.

The purpose of the order is to address the potential direct contact hazards presented by the drums,containers, and tanks identified in the Removal Action Plan contained in the Administrative Record. The scope of work described in the order would go far beyond that needed to address these relatively limited potential direct contact hazards. In conferences held following the issuance of the order, U.S. EPA has agreed to limit the scope of work required under the order to the following:

1. Removal and disposal of 27 55-gallon metal drums identified in the Removal Action Plan contained in the Administrative Record, eleven of which are empty.

2. Removal and disposal of five small metal containers identified in the Removal Action Plan continued in the Administrative Record.

3. Cleaning and to the extent applicable, emptying (and related disposal of contents) of the two underground tanks and the one above-ground tank identified in the Removal Action Plan contained in the Administrative Record.

4. Erection of fencing around the immediate vicinity of the drums to be removed from the site.

This work plan addresses each of the agreed actions listed above, which collectively are intended to eliminate or mitigate all potential direct contact hazards present at the site.

Weston's TAT report dated January 4, 1990, (TAT document number 05-G2-01586) identified the following potential hazards.

Three Bulk Storage Tanks

T1	500 gallon	empty
T2	500 gallon	locked contents unknown
T3	8000 gallon	empty

27 Drums - 55 gallons each

11	empty
16	full

5 Pails - 5 to 15 gallons each

2 contained grease

Four drums presumed to contain hazardous substances (i.e.: grease and paint wastes) were sampled. Three of the samples, B9, B16 and B17 were hazardous for ignitability, all having a flash point below 75 degrees Fahrenheit. The fourth sample, B4, having a flash point greater than 212 degrees fahrenheit, was not characterized as ignitable. The source of the waste materials is unknown.

Prior to initiating this work, the U.S. EPA has ordered in a letter dated March 21, 1990, that the following documents be submitted for review:

- Overall Project Work Plan
- Site and Health Safety Plan
- Waste Sampling and Analysis Plan
- Laboratory QA/QC
- Transportation and Disposal Plan

The attached materials have been prepared to address the U.S. EPA requirements.

PROJECT SCOPE

Great Lakes Environmental Services will dispatch a sampling van, chemist and two trained technicians to the site when given approval to proceed. The van will be equipped with the necessary sampling gear and Level B personal protective equipment. Waste materials will be inventoried and containers will be assessed for structural integrity. Samples will then be collected for analysis. Empty drums will be separated from drums containing materials for proper handling. All drums containing waste will be repackaged in 85 gallon overpack drums. Overpacked drums will be labeled and staged for later transport.

Great Lakes Environmental Services will transport the samples to Great Lakes' laboratory where the samples will then be screened for additional hazardous characteristics in Great Lakes' laboratory. Based upon these results, compatible waste samples will be composited. The samples and chain of custody document will be submitted to an appropriate disposal facility for testing in accordance with disposal facility's requirements.

Concurrently, Great Lakes Environmental Services tank cleaning crew will inspect and clean the three (3) bulk storage tanks identified in the Weston TAT report. Personnel will be prepared for confined space entry in the event that the tanks cannot be completely cleaned without entry. A Great Lakes Environmental Services confined space entry permit will be completed prior to entering any tank or confined space. Confined space procedures are provided in Appendix B.

After the disposal site(s) have approved the wastes, Great Lakes will remobilize labor and equipment to the Albion Sheridan Township site for waste consolidation, repackaging and staging. This will include the proper labeling of all wastes. The identified wastes will then be transported via licensed vehicles to the selected disposal facility. Following disposal of all materials off-site, Great Lakes Environmental Services will prepare a waste disposal certification report for submittal to the U.S. EPA. This report will summarize analytical results, volume totals, and a waste disposal summary.

Following off-site waste disposal and prior to completion of the disposal certification report, representatives from Great Lakes Environmental Services, Participating Respondents, and the U.S. EPA on scene coordinator will perform a walk-through tour of the facilities, to assure that all identified waste materials have been disposed. The scope of work is described in detail in the following section. An outline of the work plan is provided in Table 1 and an estimated schedule for completing the work is provided in Table 2.

WORK SCOPE

PHASE I. SITE SECURITY

Prior to starting the sampling and tank cleaning phases of this project, the site will be secured to discourage trespassing per discussions with U.S. EPA at May 23, 1990, meeting. Approximately 825 feet of the sites perimeter will be fenced. Cyclone fencing, eight feet high with three barbs will be installed. Signs will be posted on the fence and along the wooded areas east of the drum disposal area to warn the public of hazardous substances.

Most of the fence will be installed on the north and south borders of the site. Signs will be installed to warn potential trail trespassers at the entrance. (See Figure 1)

There will be three gates installed, one at the Michigan Avenue and two gates south of the site to regulate entrance from Division (Erie) Road.

PHASE II. DRUM STAGING PAD

On a flat area of the site,in close proximity to the drums of concern, Great Lakes Environmental Services will utilize a "Bob Cat" to scrape a level area for the staging pad. The size staging pad will be approximately 10 x 20, or as needed. The pad will be lined with four layers of visqueen. The visqueen will be secured around the perimeter of the pad, with earthen berms and lumber.

PHASE III. SAMPLING

SAFETY - Every day prior to commencing work, the Great Lakes Environmental Services foreman will conduct a site safety meeting and review the site safety plan with all on-site personal.

Also prior to commencing work Great Lakes Environmental Services will designate a corridor for entering and exiting the "Hot Zone" work area. In this area, all personnel entering the work area will be required to dress in their proper protective level as required and to decontaminate as required. (See site saftey plan appendix A)

Fire and emergency notification equipment will be available in the "Hot Zone", this will consist of 1 type ABC fire extinguisher and a hand held walkie talkie for communication with the Great Lakes Environmental Services Project Supervisor.

SAMPLING/INVENTORY - Containers will be numbered, and a representative sample will be taken from each. (See Appendix A) Samples will be labeled and numbered to correspond with the containers. All work will be performed under Level B personal protection (SCBA). See Site Safety Plan - Part I and appendix C for Sampling procedures.

CONTAINER ASSESSMENT - All containers will be examined for suitability for transport and results recorded on a standard form. (appendix C)

OVERPACKS - All drums, excluding the non RCRA empty drums, will be overpacked in preparation for secure transport. Overpacks drums will be staged on the diked drum staging pad.

Empty drums will be transported to Great Lakes Environmental Services to be crushed. Crushed drums will then be transported for disposal.

SAMPLE RESEARCH AND SCREENING - Hazardous waste characteristics and compatibility screening will be performed at Great Lakes Environmental Services (See Appendix D for procedures)

AIR MONITORING - an HNu Meter will be used to sample the ambient air surrounding the hot zone. Readings will be recorded at 20 minute intervals, should the contaminant levels exceed acceptable limits, the hot zone will be expanded to protect support personnel. As a precautionary measure all personnel involved in drum sampling and handling will use level B protection. Furthermore, because the site will be secured to keep unauthorized people from entering, expose to the general population is not expected to occur.

COMPOSITING OF COMPATIBLE MATERIALS - Samples with comparable characteristics will be composited to reduce the number of waste streams. (See Appendix D)

DISPOSAL OPTIONS/LABORATORY ANALYSIS DETERMINATION/WASTE CLASSIFICATION
Using the results of the sample screening and research, Great Lakes Environmental Services will target appropriate disposal methods and sites for each waste stream. Following site approval from the on-site coordinator and participating respondents, analysis necessary to secure approvals and classify wastes properly will be performed. In general, the waste materials have been identified in the TAT report to be of a hydrocarbon nature requiring analysis for hazardous characteristics. (ie. corrosivity, ignitability, reactivity, and E.P. toxicity) The waste streams will also be analyzed for polychlorinated biphenyls and BTU's per pound. If disposal will take place after September 26, 1990, TCLP analysis will be performed instead of E.P. toxicity.

PHASE IV. TANK CLEANING

Great Lakes Environmental Services will mobilize personnel and equipment including a foreman with a pickup and 2 field technicians. A safe, workable area at the site will be designated as the construction zone. Inside this area a "Hot Zone" will be established for protection of all site personnel and will be off limits to unauthorized personnel. The work areas will then be thoroughly inspected to determine the best equipment for the project activities. Personnel will then be familiarized with the site. A Site Safety meeting will take place daily, prior to starting work.

Procedures which will be used to clean the tanks are outlined below:

1. Designate a corridor for entering and exiting the "Hot Zone" work area. In this area, all personnel entering the work area will be required to dress in their proper protective level as required and decontaminating as required. (See site safety plan Appendix A)

   Fire and emergency notification equipment will be available in the "Hot Zone", this will consist of 1 type ABC fire extinguisher and a hand held walkie talkie for communication with the Great Lakes Environmental Services Project Supervisor.

2. Decontaminate the three (3) bulk storage tanks. One 8,000 gallon tank and two partially exposed 500 gallon tank. Decontamination will involve the use of a pressure washer and citrikleen. Decontamination fluids will be captured for disposal.

3. Tank residuals and wash water will be collected in a 3,000 gallon vacuum tanker. Disposal options are dependant upon outcome of analytical and volume of liquid generated. Typically disposal sites require ignitability, corrosivity, reactivity, and EP tox metals.

4. If tank entry is necessary to clean tanks, complete a "confined Space Entry Permit" for each tank. A new permit must also be completed after resting breaks, prior to returning tank entry.

5. The 10,000 gallon tank will be cut along its longitudinal axis to insure that confined space hazards do not exist.

6. Secure site.

7. Demobilize crew back to Great Lakes Environmental Services.

For more information on confined space entry, refer to Appendix B.

PHASE V. TRANSPORTATION AND DISPOSAL

A. Empty Drums - If the empty drums meet the RCRA empty definition they will be considered non-hazardous. Non-hazardous drums will be transported to Great Lakes Environmental Services. The empty drums will be crushed on site at Great Lakes Environmental Services, then transported in a roll-off to Wayne Disposal, Inc. in Belleville, Michigan for disposal in their type II landfill.

B. Liquids - Based on EPA and Participating Respondent approval tank residuals and decontamination wash water will be transported to either Environmental Waste Control, located in Inkster, Michigan, or to Chem-Met services, located in Detroit, Michigan. The Chem-Met option will be utilized if the solids content is too high for acceptance at Environmental Waste Control.

C. Overpack Drums - Will be transported to an appropriate disposal facility. via. Great Lakes Environmental Services fully licensed hazardous waste hauling vehicles.

TABLE 1

SCOPE OF WORK

ALBION-SHERIDAN TOWNSHIP SITE

ALBION, MICHIGAN

PART 1: SAMPLE INVENTORY, SCREENING, COLLECTION, ANALYSIS

A. Prepare Overall Work Plan
   1. General Project Scope
   2. Site Health and Safety Plan
   3. Sampling and Analysis Plan
   4. Laboratory QA/QC Plan
   5. Transportation and Disposal Plan

B. Preliminary On-Site Work
   1. Fence Site
   2. Construct Staging Pad
   3. Waste Inventory
      a. number of containers and size
      b. approximate material volume
      c. assess container condition
      d. assess material physical characteristics (gas, liquid, solid)
   4. Collect sample of all wastes

C. Tank Cleaning
   1. Remove free liquid
   2. Clean and decontaminate tanks
   3. Complete confined space entry permit if necessary
   4. Cut 8,000 gallon tank

D. Preliminary Off-Site Work
   1. Screen all remaining samples
   2. If feasible, perform material research, e.g MSDS
   3. Combine compatible samples and target disposal sites
   4. Submit samples for analytical testing
   5. Obtain approval of disposal site(s) from U.S. EPA and PRP's.
      a. complete profile sheets
      b. submit samples for site evaluation
      c. identify primary and secondary disposal sites

PART 2: SAMPLE REPACKAGING, STAGING, ETC.

A. Combine Similar Wastes
B. Repackaging in Oversized or Alternate Containers
C. Label and Mark All Containers
D. Stage Materials for Off-Site Disposal
E. Complete Manifests Prior to Transport

PART 3: WASTE DISPOSAL

A. Transport Off-Site
    1. Load waste hauling vehicle
    2. Placard vehicle as necessary
B. Dispose of Waste Off-Site
C. Waste Disposal certification
    1. Summarize identified waste types and quantities
    2. Summarize disposal results
    3. Make copies of manifests - Generators 2nd Copy
    4. Submit report to U.S. EPA
        a. include above information
        b. include generator certification
        c. include copies of all laboratories results

PART 4: SITE INSPECTION

A. Final summary report
    1. Field notes
    2. Analytical results and waste profile sheets
    3. Manifest copies
    4. Comments from walk through inspection
    5. Any other relevant documentation

4/23/90 Meeting w EPA

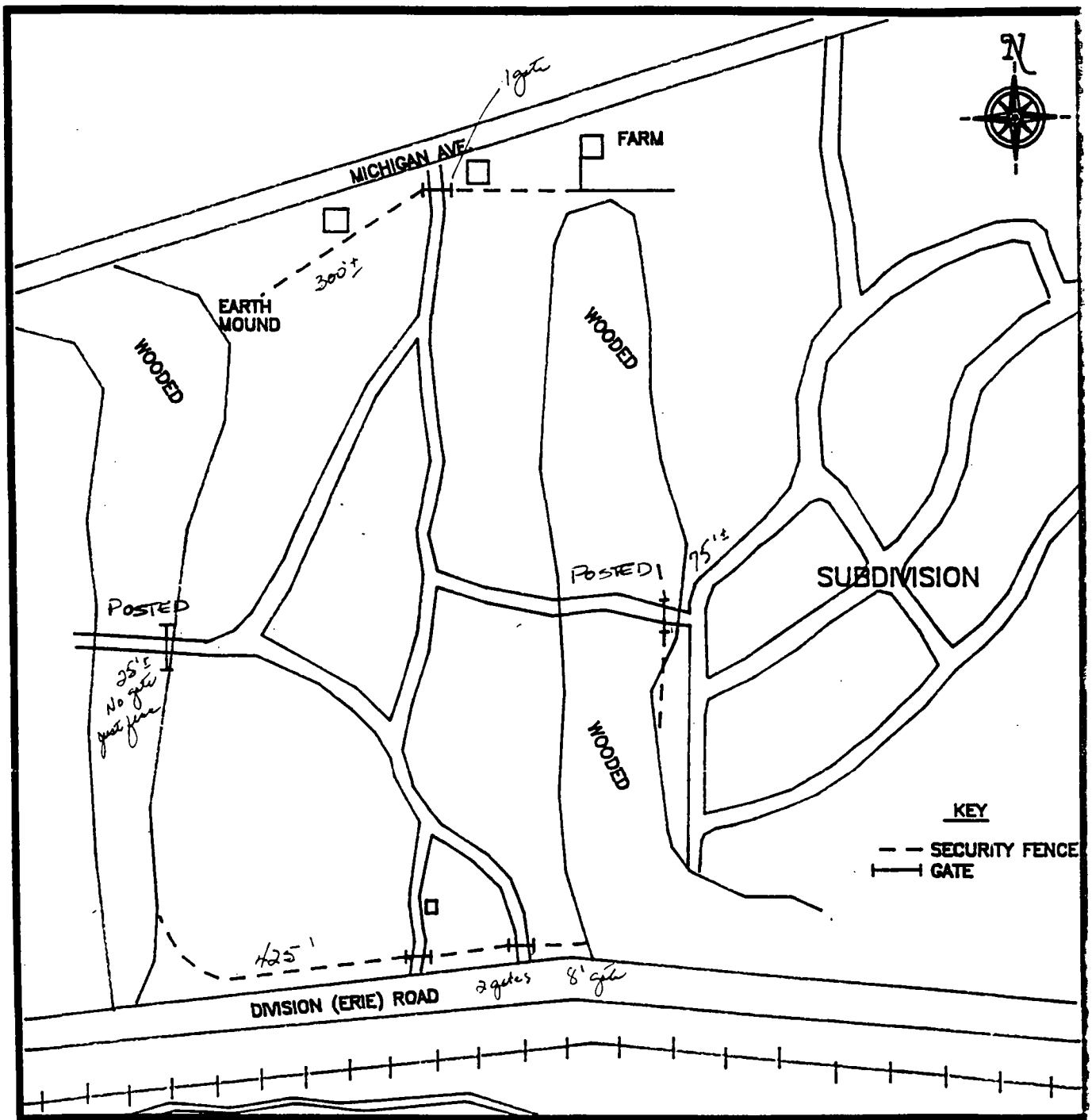


FIGURE 1

PROPOSED FENCE/GATE LOCATIONS
SCENARIO 1
ALBION–SHERIDAN TWP. LANDFILL
ALBION, MICHIGAN

WESTON MANAGERS DESIGNERS/CONSULTANTS
MAJOR PROGRAMS DIVISION
REGION V TECHNICAL ASSISTANCE TEAM

DRAWN BY	DATE	PCS #
DD	4–11–90	2684

09

TABLE 2

TIME LINE
FOR
SURFACE REMOVAL ACTION PLAN
SHERIDAN/ALBION TOWNSHIP

DAY NUMBER:	1	2	3	4	5	6	7	8	9	10	35	36	37	38	39	40	41	42
SECURE SITE (FENCING & POSTING)	----------																	
DRUM SAMPLING, STAGING AND IDENTIFICATION					------													
CHARACTERIZATION							---											
TANK CLEANING	----------																	
DISPOSAL APPROVAL FORMS								---------			----------							
TRANSPORTATION & DISPOSAL																		------

APPENDIX A

SITE SAFETY PLAN

SITE SAFETY PLAN

FOR:

ALBION - SHERIDAN TOWNSHIP LANDFILL

13355 29 MILE ROAD

ALBION, MICHIGAN

DRUM SAMPLING PROJECT

Prepared by: Andrea Lang

Date: May 25, 1990

GREAT LAKES ENVIRONMENTAL SERVICES, INC.

Site Health and Safety Plan

Outline

A. Project Description

B. Project Number

C. Site Address

D. Project contact Personnel

E. Site Location Map

F. Vicinity Map

G. Work Scope

   1. Project Specifications
   2. General Information

H. Hazardous Materials Description

I. Personal Protective Equipment

J. Site Decontamination Procedures

K. Site Contingency Plan

   1. Emergency Telephone List
   2. Transportation Spill Contingency Plan
   3. Spill Kits

L. Employee Medical Aid

   1. First Aid
   2. CPR
   3. Accident Report Form

M. Hazard Communication Program

   1. Field Operations Chemical List
   2. Material Safety Data Sheets

SITE SAFETY PLAN

Great Lakes Environmental Services, Inc.

Special Project Group

Before site operations begin all employees and subcontractors involved in these operations will have read and understood this site safety plan and will sign the form at the end of this document.

SITE SAFETY PLAN

Great Lakes Environmental Services, Inc.

Special Projects Group

A. **Project:** Characterization and disposal of surface materials and tank cleaning.

B. **Great Lakes Environmental Services No.** 30-6206

C. **Location:** Albion Sheridan Township Landfill
13355 29 Mile Road
Albion, Michigan

D. **Contact Personnel**

Eagle Picher

Paul Harper		(513)629-2418

Warner, Norcross & Judd

Scott Hubbard		(616)459-6121x495
Kathryn Lynnes		(616)459-6121x462

U.S. EPA

Jason El-Zein	On-Scene Coordinator	(313)692-7686
Beth Henning	Assistant Regional Counsel	(312)886-6831

Great Lakes Environmental Services

Walt Grabowski Car Phone	Environmental Service Coordinator	(313)758-0400 (517)740-0860
Andrea Lang	Health and Safety	(313)758-0400
John Phelps	Director of Development	(313)758-0400
Tony Reaves	Project Supervisor	(313)758-0400

E. SITE LOCATION MAP

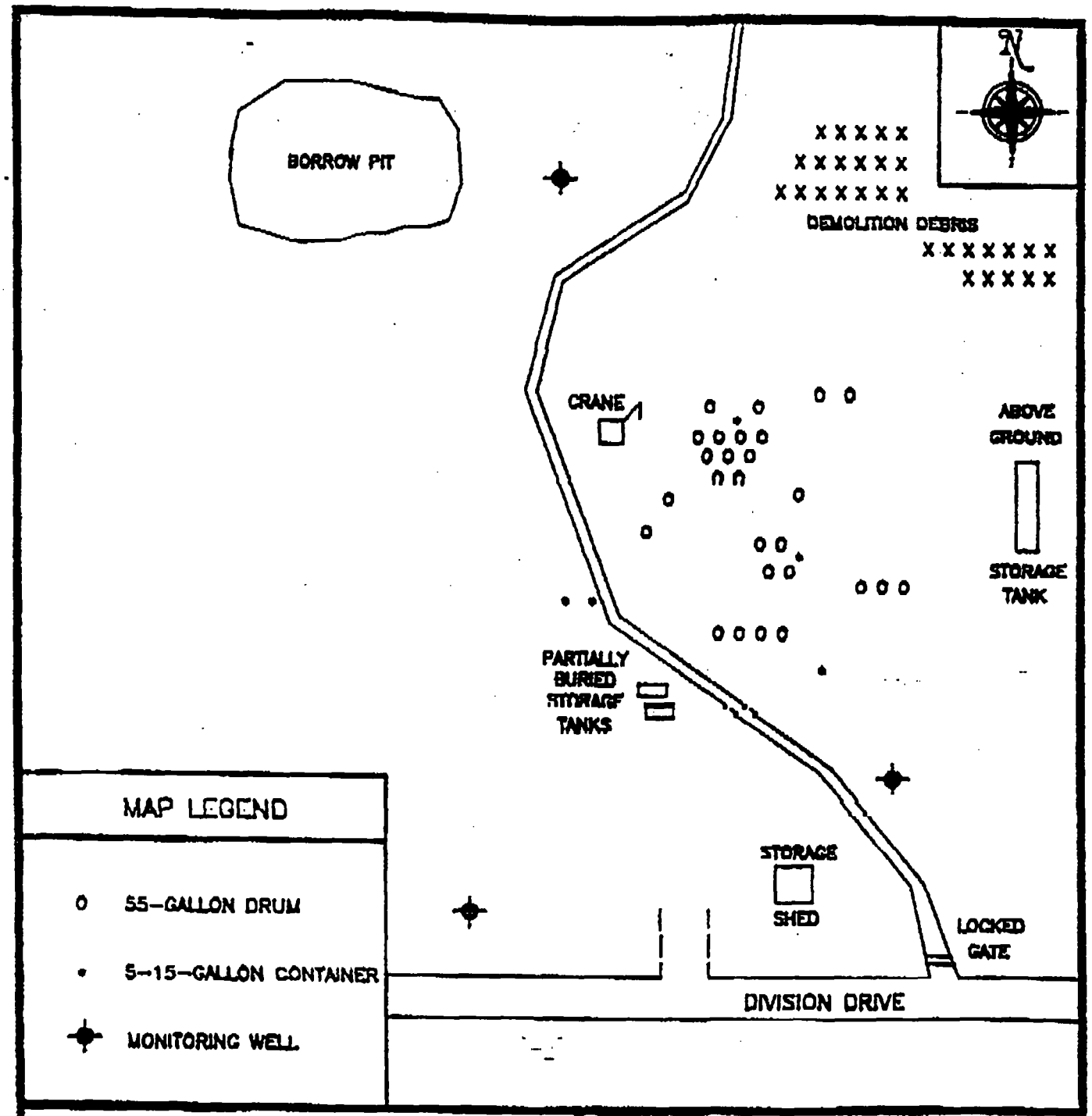


FIGURE 3

SITE MAP

ALBION-SHERIDAN TOWNSHIP LANDFILL

ALBION, MICHIGAN

NOT DRAWN TO SCALE

WESTON MANAGERS DESIGNERS/CONSULTANTS

DRAWN BY J. BOECKMAN	DATE 11-20-89	PCS # 2428
APPROVED BY J. BINKLEY	DATE 11-20-89	TDD # 5-8910-04

F. VICINITY MAP

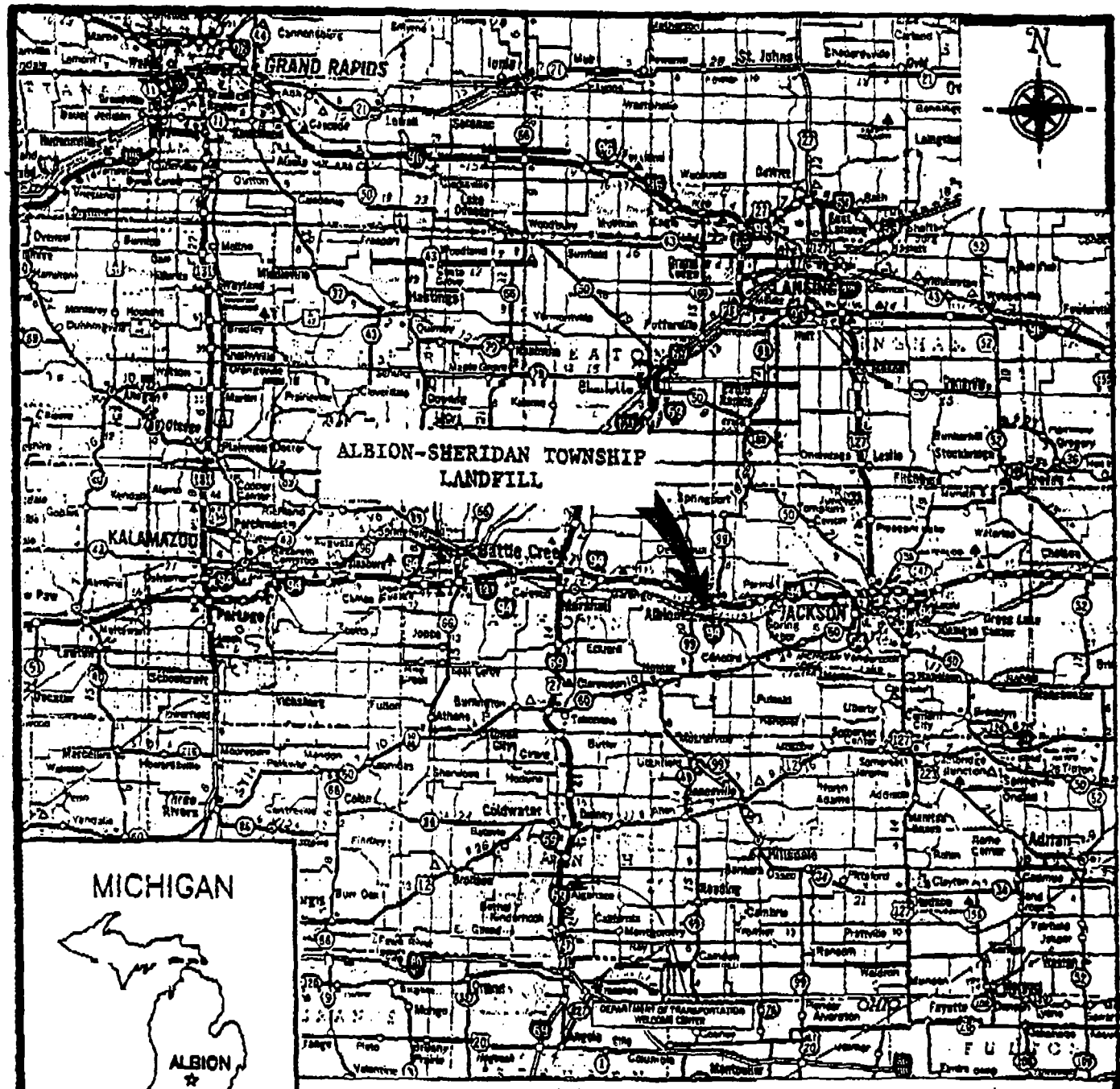


FIGURE 1

SITE LOCATION MAP

ALBION-SHERIDAN TOWNSHIP LANDFILL

ALBION, MICHIGAN

SCALE: 1 INCH = 14.5 MILES

WESTON MANAGERS DESIGNERS/CONSULTANTS

DRAWN BY J. BOECKMAN	DATE 10-23-89	PCS # 2426
APPROVED BY J. GINKLEY	DATE 10-23-89	TDD # 5-8910-04

G. WORKSCOPE

STARTS ON PAGE 3 OF THIS DOCUMENT

H. Hazardous Materials Description

1. Type: Liquid X Solid X Sludge X Vapor/Gas X

2. Chemical name/class: Assumed sampling unknown chemicals. List of materials that may potentially be encountered are described in the work plan.

3. Characteristics: Corrosive_____ Ignitable X Volatile X
Toxic X Reactive_____

4. Toxicity: TLV_____ IDLH_____

5. Specials hazards: See #2 above, and possible confined space entry;confined space entry permit is attached.

6. Acute expose symptoms: any irritation to eyes, skin or mucous membranes; dizziness or giddiness; nausea; or difficulty in breathing. Symptoms should not be encountered due to the use of 'Level B' protective equipment.

7. Hazard level: High X Moderate_____ Low____ Unknown_____
Inhalation X Ingestion X Contact X

I. Personal Protective Equipment

1. Entry level of protective clothing:

   A._____ B.__X__ C.____ D._____

2. Respiratory protection equipment:

   SCBA____X_____
   Full face respirator_____ Cartridge type_____
   Half face respirator_____ Cartridge type_____
   Dust mask_____

3. Protective Clothing

LEVEL A should be worn when the highest level of respiratory, skin, eye, and mucous membrane protection is needed.

_____ Positive-Pressure (pressure demand), SCBA MSHA/NIOSH approved) REQUIRED

_____ Fully encapsulated chemical resistant suit REQUIRED

_____ Gloves, chemically resistant REQUIRED

_____ Boots, chemical resistant, steel toe and steel shank REQUIRED

_____ Hard hat (under suit)

_____ Coveralls (under suit)

_____ Two-way radio communication

LEVEL B protection should be selected when the highest level of respiratory protection is needed, but a lesser level of skin and eye protection. LEVEL B protection is the minimum level recommended on initial site entry until the hazards have been further identified and defined by monitoring, sampling, and other reliable methods of analysis, in personnel equipment corresponding with those findings utilized.

__x__ Positive-Pressure (pressure demand), SCBA (MSHA/NIOSH approved) REQUIRED

__x__ Chemical resistant clothing (overalls, jacket coverall, hooded two piece chemical splash suit, disposable chemical resistant coveralls) REQUIRED

__x__ Coveralls (under splash suit)

__x__ Boots, outer, chemical resistant, steel toe and shank REQUIRED

__x__ Hard hat

__x__ Two-way radio communication (between hot zone and site foreman)

LEVEL C protection should be selected when a type of airborne substance is known, concentrations measured, criteria for using air purifying respirators met, and skin and eye exposure is unlikely.

_____ Full face, air purifying respirator (MSHA/NIOSH approved) REQUIRED

_____ Chemical resistant clothing (one piece coverall, hooded two piece chemical splash suit, chemical resistant hood and apron, disposal chemical resistant coveralls) REQUIRED

_____ Boots, chemical resistant, steel toe and shank REQUIRED

_____ Hard hat

_____ Two-way radio communication

_____ Escape mask

LEVEL D is primarily a work uniform. It should not be worn on any site where respiratory or skin hazards exist.

_____ Safety glasses

_____ Work uniform

_____ Hard hat

_____ Steel toe and shank boots

4. Annual Physical Requirements

Great Lakes Environmental Services provides a thorough annual physical to all employees. The physical is designed to meet all governmental requirements relative to our type of work such as Department of Transportation (DOT) driver physical, OSHA respirator use physical, and EPA clean up contractor medical requirements. The extensive annual physical helps provide a baseline for the doctors to use in charting each employees state of health over time.

J. Decontamination Procedures

Decontamination is the process of removing contaminants that have accumulated on personnel and equipment. Decontamination protects workers from hazardous substances that may contaminate the permeate clothing, respiratory equipment, tools, vehicles, and other equipment used on site. It protects the site personnel by minimizing the transfer of potentially harmful materials into clean areas and protects the community by preventing uncontrolled transportation of contaminants from the site.

In the decontamination zone, all personnel will remove contaminated equipment and clothing in the following order:

1. Drop equipment
2. Tape removal
3. Outer boot removal
4. outer glove removal
5. Outer chemically protective suit and hard hat
6. Inner glove and boot removal
7. SCBA removal
8. Wash face and hands (field wash)

All clothing is disposable and will be disposed of as contaminated material. All other contaminated items will be securely packaged and decontaminated at Great Lakes Environmental Services. No gross contamination of personnel is expected to occur.

All personnel entering the zone of contamination will dress in their protective gear following the above order in reverse.

For details refer to the Decontamination layout on the next page.

K. Emergency Telephone List

The Project Foreman and each group coordinator will be equipped with an emergency notification device to alert all work crew members in case of any emergency situation.

Emergency notification will be two short blasts with the horn in repeated intervals of five seconds. Upon hearing the emergency notification, the Project Foreman and group coordinator (s) will direct all personnel to a predetermined Safe Zone. The Project Foreman and group coordinator(s) will be responsible for coordinating any necessary first aid procedures and implementing any other required emergency action.

County/Name	Phone Number
Police: Albion	(517) 629-3933
EMS: Albion	(517) 629-9431
Albion Fire Department	(517) 629-3933
Hospital: Albion Community	(517) 629-2191

NOTE: Albion Community Hospital was contacted on May 24, 1990, and asked if they could treat chemical emergencies. They responded that they could.

Directions to Hospital: 29 Mile road west to first cross street and turn left (south), turn right (west) on 28 Mile road. Take 28 Mile road into town (5-6 miles) (road name will change to Eaton Street) follow to Erie, turn right, Albion Community Hospital is 3-4 blocks down on Erie Street.

National Poison Control Center	(502) 432-9516
Chemtrec	1-800-424-9300
Nearest Phone	Supervisor's Pick-Up

K. Emergency Telephone List (con't)

In the event of an accidental or intentional release of a "hazardous substance" in a reportable quantity, the person in charge of the incidental shall notify:

U.S. Coast Guard National Response Center 1-800-424-8802

State Notification:

Michigan DNR Pollution Emergency Alert	1-800-292-4706
Ohio	1-800-282-9378
Indiana	(317) 633-0144
Illinois	(217) 782-7860
Wisconsin	(608) 266-3232

Transportation related hazardous material accidents where:

1. A person is killed or hospitalized; or

2. Property damage exceeds $50,000.00; or

3. A continuing danger exists . . .

. . . The U.S. Department of Transportation (1-202-426-1830) must be contacted in addition to the applicable federal and state numbers.

APPENDIX B

CONFINED SPACE ENTRY PROCEDURE

CONFINED SPACE ENTRY

Great Lakes Environmental Services

Confined Space - any space having a limited entrance or egress (exit) which is subject to the accumulation of toxic or flammable contaminants or the development of an oxygen deficient atmosphere. Confined spaces include storage tanks, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, tank trucks, pipelines, and open top spaces more than four (4) feet in depth such as pits, tubs, vaults, and vessels. There can be many other unique situations in which a combination of entry/exit factors, ventilation problems, and other working conditions may require the careful planned approach of a confined space entry.

GREAT LAKES ENVIRONMENTAL SERVICES REQUIRES THAT ALL EMPLOYEES CAREFULLY COMPLETE AND COMPLY WITH ALL REQUIREMENTS OF THE GREAT LAKES ENVIRONMENTAL SERVICES CONFINED SPACE ENTRY PERMIT BEFORE ENTERING ANY CONFINED SPACE!

CONFINED SPACE E Y/WORK PERMIT

Great Lakes Environmental Services

Job Name _____ Job No. _____

Location _____

Description of Work _____

_____

Entry Date _____ Time _____ Permit Expires _____

Crew Leader _____

This form must be filled out by the crew leader and signed by the persons indicated. All questions are to be answered and all actions are to be in accordance with standard operating procedures for confined space entry as covered in the Great Lakes Environmental Services' safety manual. A new permit is required after a meal break and for each new shift.

- PERMIT MUST BE COMPLETED BEFORE ENTRY -

Emergency Medical Aid contact is: _____

Emergency Fire Aid contact is: _____

Emergency Confined Space Evacuation Signal is: _____

What are the contents of the tank, pit, etc? _____

_____

What are the expected hazards? Describe: _____

_____

Have the contents of the confined space been removed as much as possible before any entry is allowed? yes [ ] no [ ]

How much material remains? _____

Can the required work be performed without entering the confined space?
yes [ ] no [ ]

Comments: _____

Continue...

Has the space been purged? If so how? yes [ ] no [ ]

Comments: _____

Will ventilation be used? yes [ ] no [ ]

Describe: _____

Is there a hatch or other opening large enough to get properly protected workers in and out of the space safely? yes [ ] no [ ]

- IF NO CONTACT SUPERVISION BEFORE ATTEMPTING ENTRY!

Are all lids, hatches, clean-outs, and other openings open and clear of obstruction? yes [ ] no [ ]

Have all switches and circuit breakers controlling pumps, conveyors, electrical lines, agitators, or other moving equipment in the space been locked open and tagged out of service? yes [ ] no [ ]

Comments: _____

Have all connecting pipes, feed lines, etc been disconnected blanked misaligned, or double blocked and bled as appropriate and tagged out?
yes [ ] no [ ]

Comments: _____

Oxygen level test results _____ $\%O_2$ Time _____

Combustible gas test results _____ %LEL Time _____

Comments: _____

signature of tester _____

Is this an Immediately Dangerous to Life or Health atmosphere yes [ ] no [ ]

IDLH = less than 19.5% O_2 - or over 20% LEL or high toxic (or unknown) levels

Continue...

Can the hazards in the confined space safely and practically be further reduced before entry? yes [ ] no [ ]

- If yes retest after hazard reduction is complete -

Retest results: _____%LEL _____%O_2 _____ time _____ tester

Respiratory protection requirements (required)

Positive Pressure Demand SCBA - Air Pack _____

Positive Pressure Demand SCBA on line with egress bottle _____

Continuous Flow Supplied Ambient Air Mask (non IDLH use only) _____

Comments: _____

Emergency SCBA (positive pressure/demand) available immediately outside of the confined space yes [ ] no [ ]

Comments: _____

Does the material require use of any special protective clothing?
yes [ ] no [ ]

Describe: _____

Area has been secured (ropes, barricade tape, etc). yes [ ] no [ ]

Confined Space Entry warning sign posted. yes [ ] no [ ]

Will additional lighting be required inside confined space? yes [ ] no [ ]

Type: Explosion proof _____ Low voltage _____ Other _____

Communications between entry person and safety monitor will be:

Visual [ ] Radio/Voice [ ] Safety line pulls [ ]

Is any special equipment (no spark tools, shovels, etc) required due to the nature of the contents or the LEL%? yes [ ] no [ ]

Describe: _____

_____

Continue...

Will "Hot Work" requiring a permit be performed on or in the confined space? (if yes - attach permit) yes [ ] no [ ]

A safety monitor has been assigned to each individual entering the confined space. Each pair of buddies must sign below: yes [ ] no [ ]

Entry Person - with -	Safety Monitor
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____

Each entry person is wearing a full body harness (and wrist-lets for narrow openings), and a secured safety line. Extras are available for emergency use.
yes [ ] no [ ]

All ladders, ramps, etc are secured so that entry personnel can exit the confined space quickly. yes [ ] no [ ]

An additional employee is available in the immediate area to assist the safety monitor(s) in an emergency. yes [ ] no [ ]

name: _____ *signature:* _____

A pre-entry briefing with the entire work crew has been held to explain duties, procedures, signals, hazards, and answer questions. yes [ ] no [ ]

Any special precautions or comments? _____

_____

I have personally inspected the work site and entry procedures and approve this permit for the described entry.

signature (on the job supervisor or crew leader) X_____

date _____ time _____

A copy of this permit must be kept immediately available at or near the entrance to the confined space while is is in effect. The permit must be turned in at the end of the shift with your crews service receipt and log in order for any air time premium to be paid.

Great Lakes Environmental Services' Confined Space Entry Program has been developed over the years to provide a safe workable approach to confined space safety. Our program has many stricter (safer) requirements than existing federal law and meets or exceeds current state laws. Our program has been designed to meet or exceed the safety requirements of our customers. Great Lakes Environmental Services will strive to comply with additional customer specific confined space entry safety requirements as long as they do not violate any of our own safety practices. Great Lakes Environmental Services' Confined Space Entry Procedures must be met as the minimum requirements for all confined space entries even if a customer has no requirements at all.

Contact your supervisor if you are asked to perform any confined space entry procedures or practices which you are not familiar with or which conflict with the procedures covered in this manual. When a customer has you complete their own confined space entry permit you must still complete a Great Lakes Environmental Services' Confined Space Entry Permit prior to entry. There are no exceptions!

1. Great Lakes Environmental Services' Confined Space Entry Procedures Must Be Followed For Every Confined Space Entry.

2. A Great Lakes Environmental Services' Confined Space Entry Permit Must Be Properly Completed Before Each Entry Into Any Confined Space. A new form must be completed prior to a new shift of employees entering the space and after each meal break prior to re-entry.

3. Failure To Follow Great Lakes Environmental Services' Confined Space Procedures Is Considered A Serious Violation of Company Policy And Is Cause For Severe Disciplinary Action or Discharge.

CONFINED SPACE - DEFINITIONS

Great Lakes Environmental Services

Atmosphere - refers to the air in a confined space including any contaminants such as dusts, vapors, mists, fumes, etc.

Bonding or Grounding - eliminates the chance of static electricity creating a spark in a combustible atmosphere by drawing off the static charge through a bonding wire (wire that connects the equipment such as a pump, tanker, or hose which could produce a static charge to a nearby electrical conductor which goes to ground) and takes the static charge to ground.

Double Block and Bleed - a process of isolating a section of pipe by closing and locking an upstream and a downstream valve and opening a drain valve in between the two secured valves.

Engulfment - getting trapped or caught by material flowing over you or enclosing you such as grain, sand, or any easily flowable material.

Hot Work - any work involving burning, welding, riveting, or similar fire or spark producing operations, as well as work which produces a source of ignition, such as drilling, abrasive blasting, and space heating, etc.

IDLH Atmosphere - an atmosphere that is Immediately Dangerous to Life or Health. An atmosphere that you could not escape from if your respiratory protection failed without risking death, serious injury, or irreversible health effects. This includes atmospheres with less than 19.5% oxygen, 20% or greater Lower Explosive Limit, or any air contaminant present at or above its' established IDLH level as found in the NIOSH Pocket Guide to Chemical Hazards.

Inerting - the practice of replacing (displacing) the atmosphere in a confined space with a non-reactive (or inert) gas, such as nitrogen, so that the resulting atmosphere is non combustible.

note: An inerted atmosphere can be extremely dangerous since the oxygen levels are greatly reduced - Great Lakes Environmental Services does not perform inerting or enter inerted atmosphere unless purged with air until further notice.

Isolation - a process by which a confined space is removed from service and completely protected against the accidental release of material by the following: blanking off (skillet type metal blank plate between flanges), disconnecting and misaligning sections of all lines and pipes, a double block and bleed system, electrical lock-out of all power sources, and blocking or disconnecting all mechanical linkages which control agitators or other moving equipment in the confined space.

Continue...

LEL (Lower Explosive Limit) - the minimum concentration of a combustible gas or vapor in air (usually expressed as a percentage) which will ignite if an ignition source (spark or flame) is present - also called LFL (Lower Flammable Limit). Our explosionmeters sound an alarm when they detect 20% LEL or more. The 20% LEL is also the IDLH level for fire and explosion hazard.

Oxygen Deficiency - occurs when the level of oxygen in an atmosphere drops below safe levels. Normal air has approximately 21% oxygen. When the oxygen level falls below 19.5% the atmosphere is considered oxygen deficient and an IDLH atmosphere. Our oxygen meters sound an alarm when the oxygen level falls below 19.5%.

Oxygen Enriched - occurs when the level of oxygen in an atmosphere rises above safe levels. Normal air has 21% oxygen. When the oxygen level rises to above 23% the atmosphere is oxygen rich. An oxygen enriched atmosphere is dangerous because materials that don't easily burn in normal air, such as clothing, etc may ignite easily with a little spark. Our oxygen meters will sound an alarm if the oxygen level exceeds 22%.

note: Pure oxygen is never used in a confined space instead of normal breathing air because of the increased fire risk.

Purging - the act of displacing (clearing out) gases, vapors, stale air, etc from a comfined space by means of blowing out with air and/or filling with water and venting.

note: Caution must be taken to avoid creating a hazardous atmosphere outside of the confined space.

UEL (Upper Explosive Limit) - the maximum concentration of a combustible gas or vapor in air (usually expressed as a percentage) which will ignite if an ignition source (spark or flame) is present. If combustible vapors or gases are present at levels above the UEL the mixture is to "rich" to ignite, however, ventilating the confined space could reduce the concentration of the gas to below the UEL which would create a possible explosive atmosphere. The UEL is sometimes called the UFL or Upper Flammable Limit.

Ventilate - to circulate fresh air through a confined space for the purpose of maintaining a safe atmosphere in the confined space usually by means of non spark vent fans or air movers.

note: Caution must be taken to avoid creating a hazardous atmosphere outside of the confined space.

CONFINED SPACES - STANDARD OPERATING PROCEDURES

Great Lakes Environmental Services

The Great Lakes Environmental Services' confined space entry/work program is centered around our confined space entry/work permit system. The permit is designed to make you look at each confined space entry with your safety as the most important thing to consider. Honestly, looking at each item covered by the permit, considering the job specific conditions, completing each of the required pre-entry steps, and demanding safe compliance from each of your co-workers will help us to avoid the senseless fatal mistakes described in the front of this section. The required permit is the reminder we all need to keep us honest with ourselves for each entry. When you're the one entering the confined space, more than your signature on the permit is on the line.

GREAT LAKES ENVIRONMENTAL SERVICES REQUIRES THAT ALL EMPLOYEES CAREFULLY COMPLETE AND COMPLY WITH ALL REQUIREMENTS OF THE GREAT LAKES ENVIRONMENTAL SERVICES CONFINED SPACE ENTRY PERMIT BEFORE ENTERING ANY CONFINED SPACE.

The entry permit covers several general areas:

1. Identification - Who?, What?, Where?, When? and Why?

2. Evaluation - Establish the hazards you'll face so you know what you're dealing with.

3. Protect/Prepare - Based on all of the information you can take proper action to prepare to do the work safely.

4. Performance - You must perform the work within the limits that 1-3 have pointed out.

5. Monitoring - You must keep track of what is going on. Work in a confined space can change the nature of the space. You must re-check the atmosphere periodically and alert everyone if conditions change which could affect hazard levels. Frequent communication with all workers is very important.

6. Emergency - You must be prepared for emergencies. Know how to sound an exit alarm and how to get help. Following an established emergency plan helps to avoid panic which is your worst enemy in a true emergency.

7. Authorization - A permit must be signed by a qualified Great Lakes Environmental Services' crew leader or on the job Great Lakes Environmental Services' supervisor approving entry for Great Lakes Environmental Services' personnel before any entry is allowed.

Continue...

The standard operating procedures summarized on the Great Lakes Environmental Services' Confined Space Entry/Work Permit are discussed in detail in this section.

1. Neatly fill in the information requested at the top of the permit as described on your work order e.g.,

   - Job Name: Globe Chemical Co. Job No: 2-9784
   - Location: Oil Tank #3, Dearborn, MI Plant 2
   - Description of Work: Clean oil sludge out of tank, wipe down, and prepare tank for inspection.
   - Entry Date: 11-18-86(today) Time: 8:00 AM Permit Expires: 12:00 PM
   - Crew Leader: I.M. Tuff

2. Fill in the emergency information. You should check with the customer and see if any site specific requirements exist such as contacting plant security or an appointed emergency contact phone number e.g.,

   - Emergency Medical Aid contact is: Plant Medical dial 999
   - Emergency Fire Aid contact is: Plant Security dial 3

     note: As a minimum, you would need the phone numbers of the local police or EMS and fire department.

   - Emergency Confined Space Evacuation Signal is: 3 horn blasts

     note: Any signal that will be able to be heard, seen, or felt is okay as long as everyone involved knows what the signal is and how to use it.

3. Describe the contents of the confined space and the expected hazards. Much of this information can be supplied with your work order or attached to it as a chemical analysis or as material safety data sheets. You still have to summarize the information on the entry permit to verify that you have reviewed it. Be careful to check that the confined space meets the description on your work order i.e., if the work order says "Chromic Acid Tank" and the customer takes you to a "Flammable Paint Tank" something is wrong and you should check with supervision before going further.

   An example of how to complete this section could be as follows:

Continue...

- What are the contents of the tank, pit, etc? Oil sludge, dirt, and water toxic for lead per analysis.

- What are the expected hazards? Describe: hazardous for lead, possible combustible gases, toxic gases, slippery footing, etc.

4. Determine what actions have been taken or could be taken to reduce the hazards or to eliminate the need for entry. The less material in the space the better. As much material as possible should be pumped or vacuumed out before considering entry. In some cases you may be able to empty the space and wash it down to the customers safisfaction without entering it at all.

Determine how much material remains in the space before entering. This could be a reading off of a dip stick and/or level gauges. Trust physical checks such as dip sticks, weighted lines, or visual more than level gauges which can become stuck or inoperable.

- How much material remains? approximately 1 1/2 feet of sludge

Making this determination will help you to avoid getting an entry person stuck in material too deep or sticky to move in safely. Tall vertical tanks like hoppers or silos for solid materials (powders or fly ash) can present a serious risk of entrapment, engulfment, or cave ins. You could compare the hazards to being caught in a whirlpool or sink hole. Also, when sticking tanks, be careful that you are not just measuring to a crusty layer of material rather than the true bottom. A couple of spaced out checks are better than one dip stick reading.

4a. Purging has been defined as the act of displacing (cleaning out) gases, vapors, stale air, etc from a confined space by means of blowing it out with air and/or filling it with water and venting. The idea is that the new non-hazardous material will fill up the confined space and push out (displace) hazardous atmosphere and contaminants. Some important things have to be considered i.e.,

1) Will the fumes, vapors, odors, etc being purged from the confined space create a hazard or an odor problem outside of the confined space?

- Venting toxic, corrosive, or flammable gases into a work area can create serious explosion and injury hazards for unprotected workers in nearby areas.

- Venting strong odors can cause concern among nearby workers and neighbors.

Continue...

2) If water or some other liquid is used to purge the tank you must consider what can be done with it after it has been used and what hazards could remain or change in the space due to using water or some other liquid.

   - Some plants can handle the purge water in their on-site waste water treatment plant. But customer permission and directions must be obtained first in all cases.

   - Some situations may require manifesting the purge water to a disposal site as a regulated waste. This should be clearly spelled out on your work order - if not - check with supervision before using any purge water.

3) Inerting is a form of purging (see definitions) which involves using an inert gas (usually nitrogen) to displace a flammable atmosphere in a confirmed space. Great Lakes Environmental Services does not perform this service. Some customers may have this ability in plant and may have inerted a tank prior to our arrival. A serious hazard exists in that the inert gas (nitrogen) will also displace usable oxygen thus making an IDLH atmosphere (severe oxygen deficiency). Contact supervision before entering any inerted confined space for specific directions.

   Purging may not be safe or practical in many cases but it should be considered where possible. Even after a space is purged hazards can (and usually will) remain at some level.

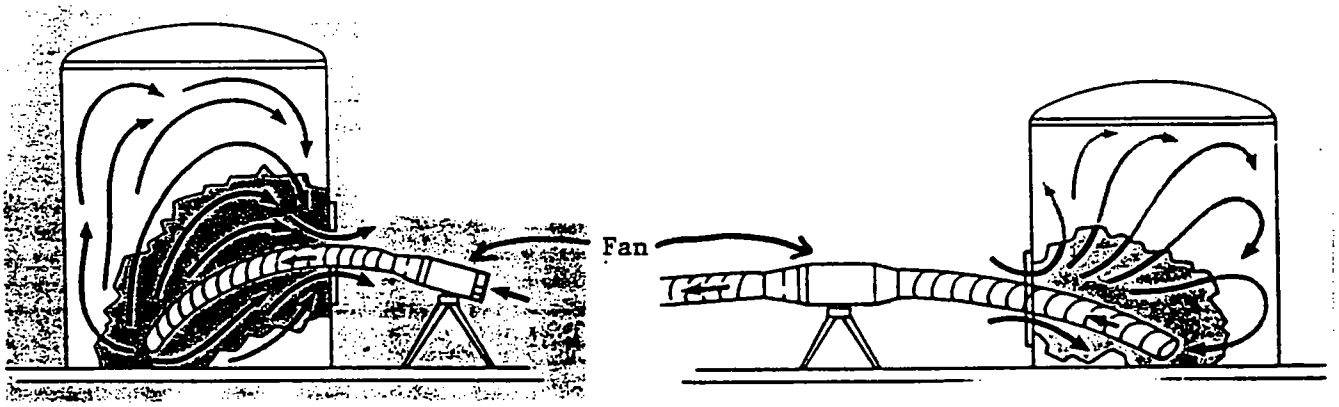
   - Gases can get trapped in hatches or in irregular or unvented void spaces which will spread through the confined space once the purging is complete.

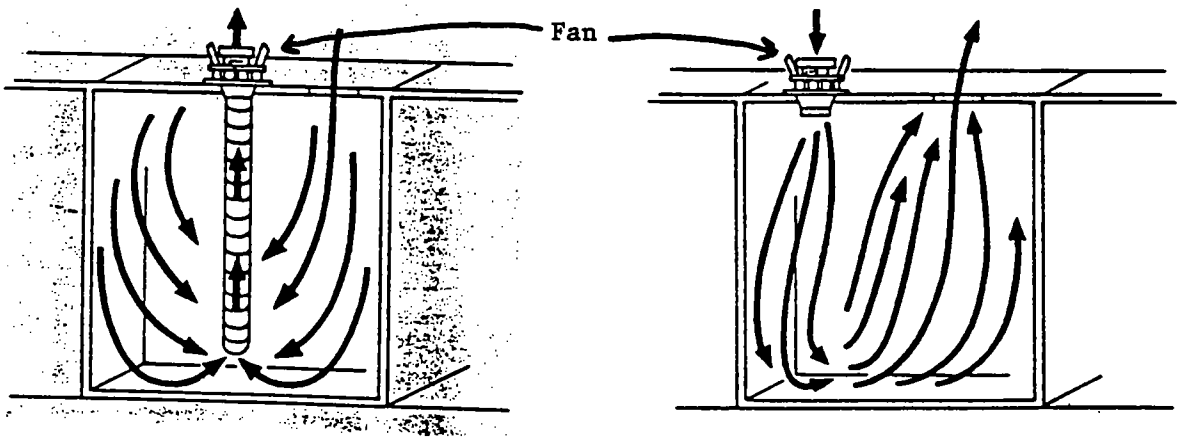
   - Residues left in the space will still present hazards. In some cases the purging material may change the air in a space but at the same time increase the hazard from a residue. e.g., Using water to purge a caustic (a base such as lye, lime, sodium hydroxide) tank can react with the solid caustic residue creating a very corrosive residue.

Just because a confined space has been purged does not mean it is safe. Making that assumption could be a fatal mistake (remember the accident case histories).

Continue...

Examples of Ventilation





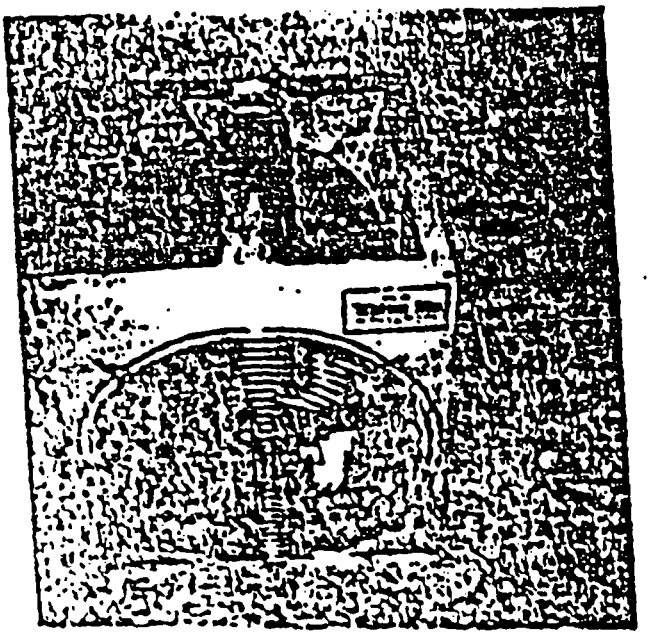
Rhine Air

9402E N. Magnolia Ave. Santee, CA 92071

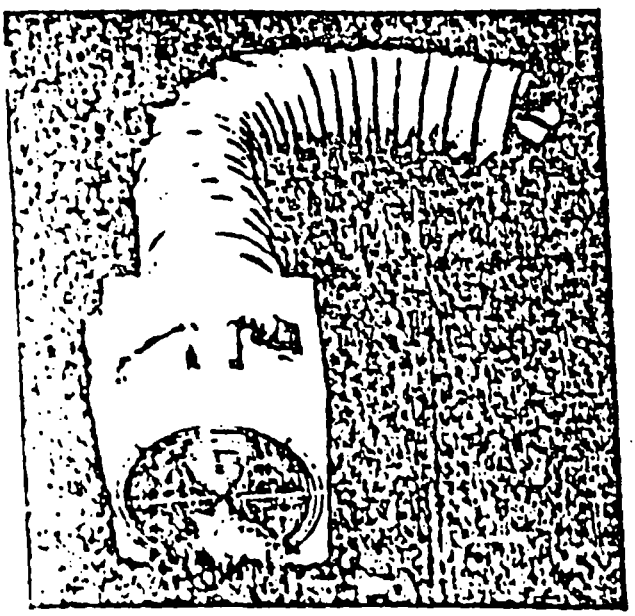
PNEUMATIC POWERED FANS

PHONE
714/460-5928

Ex 7



16" Fan



12" Fan

CAUTION

DO NOT EXCEED 3000 RPM'S

ONLY USE SAME SIZE DUCTING AS BLADE DIA.

USE ONLY NON-COLLAPSIBLE DUCTING

RHINE AIR FEATURES

Portable Unit
Completely Pneumatic
Variable Output
Burn-out Proof
Simple Rugged, Compact Construction
Weight - 16" Fan 44 lbs.
Weight - 12" Fan 34 lbs.
16" Fan Displacement 4700 CFM at 3000 RPM
12" Fan Displacement 2200 CFM at 3000 RPM
Welded Steel Frame
Cast Aluminum Blade
Steel Closed Mesh Safety Guards
Vane Type Air Motor With Exhaust Silencer
Throttle Valve Lock Adjustment with RPM Tachometer
3 H.P. Air Motor in Both 16" and 12" Fan

AIR FAN MOTOR REQUIREMENTS

Air motor must be attached to air supply by use of 1" I.D. hose or inlet supply. The air supply compressor must have an output of 45 cu. ft. min. at 60 P.S.I. (100 P.S.I. Max.)

COLD WEATHER OPERATION

When starting up the fan at temperatures near or below freezing, make certain there is no water in the air supply line. It is recommended that the air supply line and/or hose be blown clear prior to attachment to the motor. Failure to carry out this precaution may result in muffler freeze-up and subsequent air motor damage. For continuous operation in subfreezing temperatures, it is highly recommended that an inlet water separator be permanently attached to the air motor.

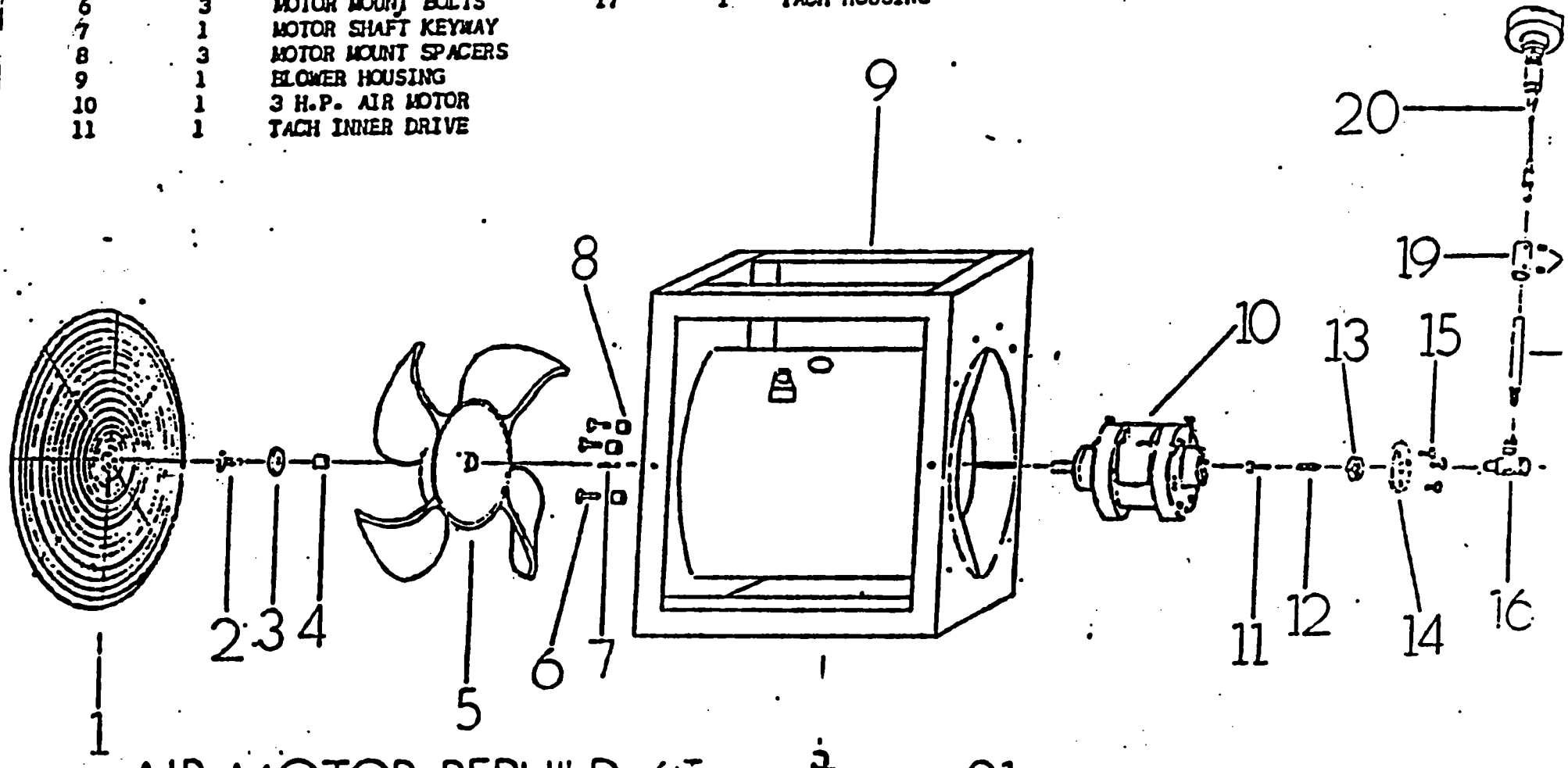
STORAGE

If fan is to be stored for an extended period of time, it is recommended that unit be run at least 5 MIN per week. Prior to storage, remove air motor lube oil plug, and pour in 1 oz. of 10 W oil. Manually turn blade. This will coat inside bore of air motor with oil and prevent surface oxidation during storage.

NOTE: If Flexaust Ducting is used, attach soft end to Fan adapter flange.

RHINE AIR 12"&16" BLOWER ASSEMBLY

ITEM	QTY.	NAME
1	2	BLADE GUARD
2	1	THRUST BOLT
3	1	THRUST BOLT WASHER
4	1	THRUST BOLT SPACER
5	1	12" or 16" BLADE
6	3	MOTOR MOUNT BOLTS
7	1	MOTOR SHAFT KEYWAY
8	3	MOTOR MOUNT SPACERS
9	1	BLOWER HOUSING
10	1	3 H.P. AIR MOTOR
11	1	TACH INNER DRIVE
12	1	PRE LOAD TACH SPRING
13	1	RT. ANGLE RETAINER NUT
14	1	RT. ANTLE FACE PLATE
15	3	RT. ANGLE MOUNTING BOLTS
16	1	RT. ANGLE DRIVE
17	1	TACH HOUSING
18	2	ALLEN SCREWS
19	1	TACH COUPLER
20	1	TACH ASSEMBLY
21	1	MUFFLER



AIR MOTOR REBUILD KIT

P/N - K208

- Has the space been purged? If so how? [X] yes [ ] no

Comments: Filled with water and flushed to API separation

4b. Ventilation has been defined as circulating fresh air through a confined space for the purpose of maintaining a safe atmosphere in the confined space usually by means of non spark vent fans or air movers. Fresh air is underlined to remind you never to use pure oxygen (green compressed gas cylinder) in a confined space because if can create severe. explosion and fire hazards.

Ventilation should be used whenever possible to help keep the air in a confined space safe. Great Lakes Environmental Services will not rely on ventilation to maintain a respirable (breathable) atmosphere because of all of the air quality problems which can occur rapidly in most confined spaces. We will bring our breathing air with us.

Ventilation can help to reduce the hazards created while working in the confined space such a combustible or toxic gas levels. You have to consider problems that can be created by ventilation. The problems are similar to those found with purging i.e.,

> Will the fumes, vapors, odors, etc being vented from the confined space create hazards or odor problems for those outside of the confined space?

In some cases venting may present a greater hazard than not venting. In either case you should describe your reasons or actions on the permit e.g.,

- Will ventilation be used? [ ] yes [X] no

Describe: Tank purged but venting could create nuisance odor problem.

5. You must make sure there is a safe way in and out of every confined space. An entry (hatch, door, etc) must be large enough to get an unconscious worker out through in an emergency. The National Institute for Occupational Safety and Health (NIOSH) recommends "If the exit opening is less than 18 inches in diameter, then a wrist type harness shall be used". (Criteria For a Recommended Standard-Working In Confined Spaces - DHEW Pub. No. 80-106, 1979). The wrist-lets would be used with a full body harness and would allow an unconscious worker to be pulled hands over head through a hatch for rescue purposes.

Continue...

The bulky safety gear, SCBA (air masks and egress bottles) equipment, and harnesses themselves add to the amount of space required for safe entry/exit. A fully equipped employee must be able to safely fit into and out of an access in order for it to be considered safe. Having one small employee squeeze into a space is not acceptable because a normal or larger size rescue worker might not be able to enter the space in an emergency to help an unconscious worker with a broken or tangled life line.

Any additional hatch lids, parts, grates, etc which can safely be removed, should be removed before allowing entry. This will aid in lighting, communications, and ventilation as well as providing possible alternate emergency access route.

<u>If there is not a safe means of entry and exit you must contact supervision</u> and report the nature of the problem before proceeding further. Alternate plans or actions may have to be considered such as:

- attempting to accomplish the goal of the job without entering the space
- checking blueprints, customer knowledge, etc for other possible access routes
- having a new or larger access made into the confined space
    - requires supervisor and customer agreement
    - may require specialized sub-contractor to "cold cut" a hatch

6. Confined space isolation procedures including lock-outs, tag-outs, blanking out, and blocking out are required to protect entry workers from:

    - being crushed or cut by moving equipment
    - being electrocuted
    - being drowned or buried by material flowing in through pipelines

All Great Lakes Environmental Services' confined space entry work is performed at customer's plants or sites (except for tank truck entry) rather than at a facility we own and operate. We must work closely with the customer's plant engineers, electricians, and safety personnel in order to identify all controls for any moving equipment in the confined space, electrical lines, and connecting pipelines (product, overflow vents, heating coils, steam, water, natural gas,

Continue...

drains, etc) or any other mechanical, electrical, or material source which could change conditions in the confined space. The customer's knowledge and familiarity with his own plant should be used as a valuable information source. The customer will also be aware if any other in plant operation will be affected and can plan for scheduling work at an acceptable time.

The Great Lakes Environmental Services' employee completing the entry permit must carefully look at the job at hand. Make sure that the customer didn't overlook a pipeline or control that looks like it should, at least, be considered. When in doubt, ask! You may find that the customer wasn't aware of some pipe or control or didn't "think" it created a hazard. You have to be sure that the space is safely isolated before and during entry.

Most pipe disconnects, blanking, etc performed in a customers plant will have to be physically performed by the customer's pipe fitters, electricians, plumbers, etc. We have to put our own tags, and locks on the locked or blanked out equipment in addition to the customers requirements.

If a customer has a problem with us putting our locks on their equipment or with other blanking or disconnecting problems, Contact Supervison Before Proceeding. Some site specific modifications may have to be allowed, but only with acceptable safety standards and with supervisions' approval. Note any changes from normal tag, lock, or block out procedures and the name of the supervisor who gave permission on the permit entry form. This flexibility is provided to account for unusual or unique situations and situations where the customer's practices will provide equal or better protection for our employees. It is not provided to simply speed-up a job or take unacceptable short cuts.

Electrical isolation of a confined space is achieved by locking circuit breakers and/or disconnects in the open (off) position with a key-type padlock and a lock out clamp (can usually accept up to six locks). Each person entering the confined space places his own lock on the lock out clamp and keeps the key for the individual lock. A tag must be attached to the lock out clamp identifying why equipment is locked out, by who, and the date.

A lock should never be removed by anyone but the person who put it on. In a real emergency situation the crew leader (permit signer) may remove a lock after confirming that the employee whose lock is to be removed is not in the confined space and posting a guard (safety man)

Continue...

at the entrance to the confined space to prevent re-entry.

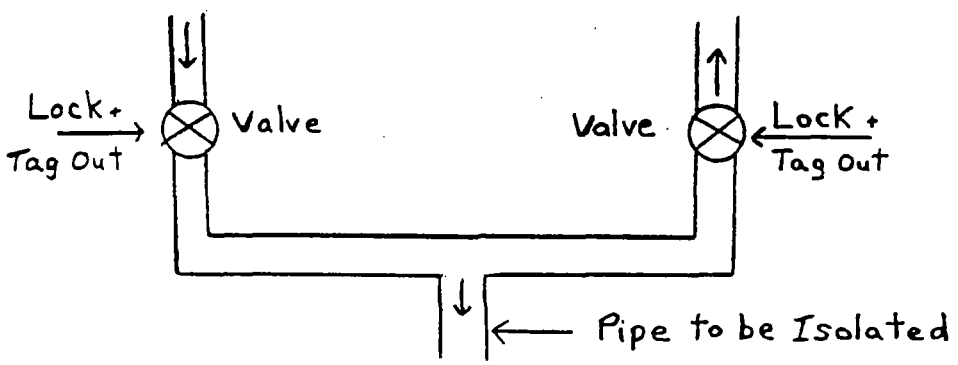
Mechanical isolation of moving parts can be achieved by disconnecting linkages, or removing drive belts or chains and blocking or wedging moving parts so they don't move. Electrical lock outs should also be performed on the equipment if at all possible.

Pipelines, steam lines, compressed air lines, etc supplying, entering, or controlling equipment in, confined spaces should be disconnected and blanked off. Blanks used to seal off lines shall be capable of withstanding the maximum working pressure or load of the line (with a good safety factor), be gasketed on the pressure side to insure a leak proof seal, and be made of a material non-chemically reactive to the material. Blanks shall also be tagged to inform others why they are blanked (a normal lock out tag is okay).

Supply pipes may be disconnected and misaligned (pulled apart) so the ends don't connect if there will be no load on the line. These sections should also be tagged so they aren't mistakenly reconnected.

Shutoff valves serving the confined space, or pipelines leading directly to it, shall be locked in the closed position and tagged for identification. A chain may be required to help secure some types of valves.

Another method that can be used in some cases is called a "Double Block and Bleed", which is for pipelines where the line of concern comes off a section of pipe or a U in the line with shutoff valves both up and downstream of the pipe you're trying to isolate, i.e.,



Blanks should be used whenever possible as well.

Continue...

- Remember the goal of all of this is to safely isolate the confined space from dangerous surprises.

  The customer should be made aware of the lockout, blanking, and tagging procedures before crews get on-site. Customers will usually use in-house pipe fitters, electricians, etc to prepare the confined space. We will have to verify what has been done and put our locks and tags on the equipment. A walk through with a customer representative is usually the best way to make sure everything is prepared.

  In some situations a drain line will be kept in service to allow for tank or pit cleaning. Valves that control these drains should be locked open and tagged.

  After the job is done you will have to ensure that our locks and tags are removed. A customer representative should also accompany you when removing final tags, locks, blanks, etc so that he can arrange for reconnection or continued lock outs of their own. This will help prevent spills and accidents after our job is complete.

- Have all switches and circuit breakers controlling pumps, conveyors, electrical lines, agitators, or other moving equipment in the space been locked open and tagged out of service? yes [X] no [ ]

  Comments: Agitator and supply pump controls locked and tagged

- Have all connecting pipes, feed lines, etc been disconnected, blanked, misaligned, or double blocked and bled as appropriate and tagged out? yes [X] no [ ]

  Comments: Oil supply line blanked and tagged out - only one

Continue...

lock it out

why do you need a lockout?

Anyone who operates equipment should be protected by personal protective gear and by the guards on the equipment itself.

But once that equipment is shut down for maintenance or repair, the protection of those guards is usually removed.

There's only one sure way you can protect yourself from unexpected operation of a piece of equipment—and that is to lock it out.

what is a lockout?

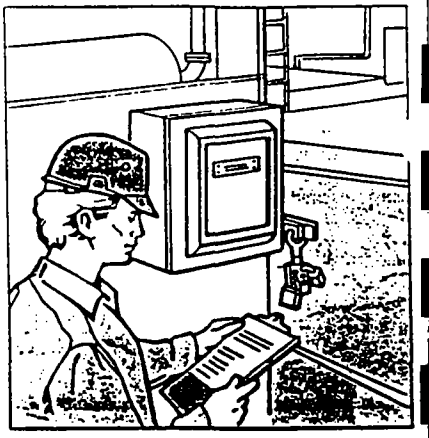
A lockout is simply a lock put on a power source to prevent accidents that might be caused by catching someone in the wrong place at the wrong time.

what kind of preparation do you need for a lockout?

Identify all the energy sources on a piece of equipment to determine where it can be isolated.

Find the energy-isolating devices and be sure they are properly labeled. Don't rely on memory, especially where complex machinery is involved.

If the system is complex, make a checklist of de-energizing and startup procedures

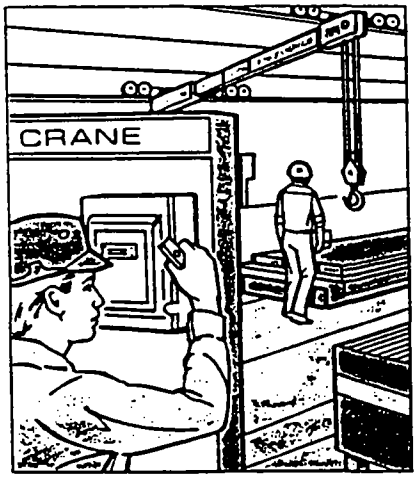


If you're about to lock out a piece of equipment, let the operator know what the scope of the lockout will be and how long you expect it to last.

how is an electrical lockout done?

An electrical lockout is normally done with an ordinary padlock.

When more than one person is going to work on equipment, a multiple lockout device should be used.



Each person should have an individual lock on the device. That way, the disconnect switch can't be closed until everybody is in the clear.

Before you turn off the power, check to be sure nobody is operating the equipment. A sudden loss of power could cause an accident.

Never pull a disconnect switch while it is under load. That could cause arcing and maybe an explosion. Shut down everything possible at the point of operation, then open the main disconnect switch with your left hand, and face away from the front of the switch box. In larger installations with high voltage, this is usually the responsibility of an electrician.

After the switch has been opened, snap your own lock on the lockout device.

Anyone else involved must put a separate lock on at this time.

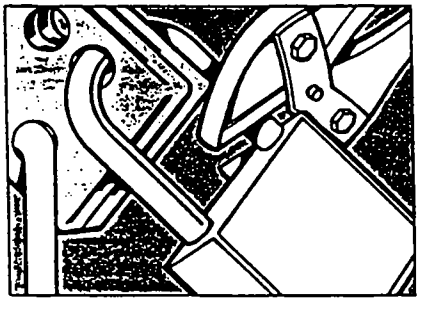
Then check the lockout device to be sure the switch, breaker or valve can't be operated. Then try the controls on the equipment itself. After you've checked the disconnect, test to be sure the power source is de-energized.

On equipment that can't be seen from the main disconnect switch location, get someone to check the machine area and signal you. Then test your lockout.

After the maintenance or repair work has been done, you are responsible for removing your own lock promptly. And if you're the last one to remove a lock, be sure to notify the supervisor that the equipment is ready to go back into service.

It's important to remember that if you are going off shift and your lock is still on, your relief must put a lock on before you remove yours.

one lock, one key



You should only have one key for your lock. Don't make duplicates, and if you lose a key, report it immediately.

Never loan or borrow a lock.

A lock should never be removed by anyone but the person who put it on—except in an emergency. If there is an emergency, call your supervisor—so at least two people are responsible for removing the lock.

watch out for shortcuts

Don't take shortcuts—like pulling a fuse, for example. Pulling a fuse is no guarantee that a circuit is dead. And what's to prevent someone from simply replacing it?

Never depend on a switch to lock out equipment. Some equipment can operate even if the switch is in the off position—and a switch can be easily shorted out.

The only positive lockout is made at the disconnect or circuit breaker.

some things to remember

Here are some other important things to remember about electrical lockouts:

Electricians or maintenance personnel should be sure breakers can be heard or felt as they are tripped out.

Disconnect switches should be checked for possible defects. Internal failure in disconnect switches can leave a circuit

energized even when the lever is in the off position. That's why it is so important to test the equipment to be sure it is de-energized.

When reversing starters are used, be sure they are locked out in both directions.

metimes you have to jog or inch a achine to move parts for maintenance or adjustment. In that case, you probably can't use a lockout on the disconnect switch. You need special vigilance at the pinch points under close supervision until regular operation can be resumed.

other sources of energy

Lockouts are also used to control hazards from other sources of energy, such as compressed air, hydraulics, gas or steam.

Steam, air and hydraulic lines should be bled, drained and cleaned out. There should be no pressure in these lines or in reservoir tanks.

Whether you're dealing with valves or electrical equipment, always test to make sure the lockout is secure and the unit can't be operated before work on it begins.

Any mechanism under tension or pressure, such as springs, should be released and blocked.

releasing the equipment

Once work on the equipment is finished, it's important to follow a regular procedure for releasing the equipment to production operations.

Be sure all equipment components are operationally intact, including guards and safety devices. Repair or replace any defective safeguards or safety devices before you remove the lockouts.

Inspect the equipment for obstructions or incomplete work.

Remove each lockout device, using the correct removal sequence.

Make a visual check before restoring energy to be sure everyone is physically clear of the equipment.

lockout-one of the most important safety procedures you can do

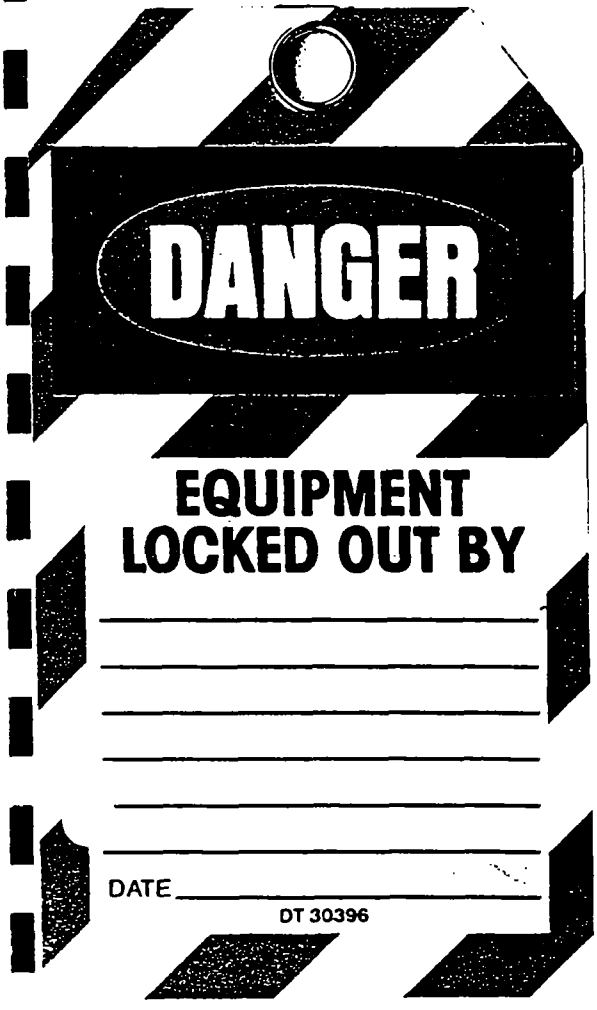
Always do a lockout, whenever you have to be sure a machine will not operate.

Don't take shortcuts with your lockouts — follow the rules to the letter.

Remember — the lock you put on that power source is there for one reason — to protect you!

National Safety Council
444 North Michigan Avenue
Chicago, Illinois 60611

SLT 21R Seton Name Plate Corp. New Ha

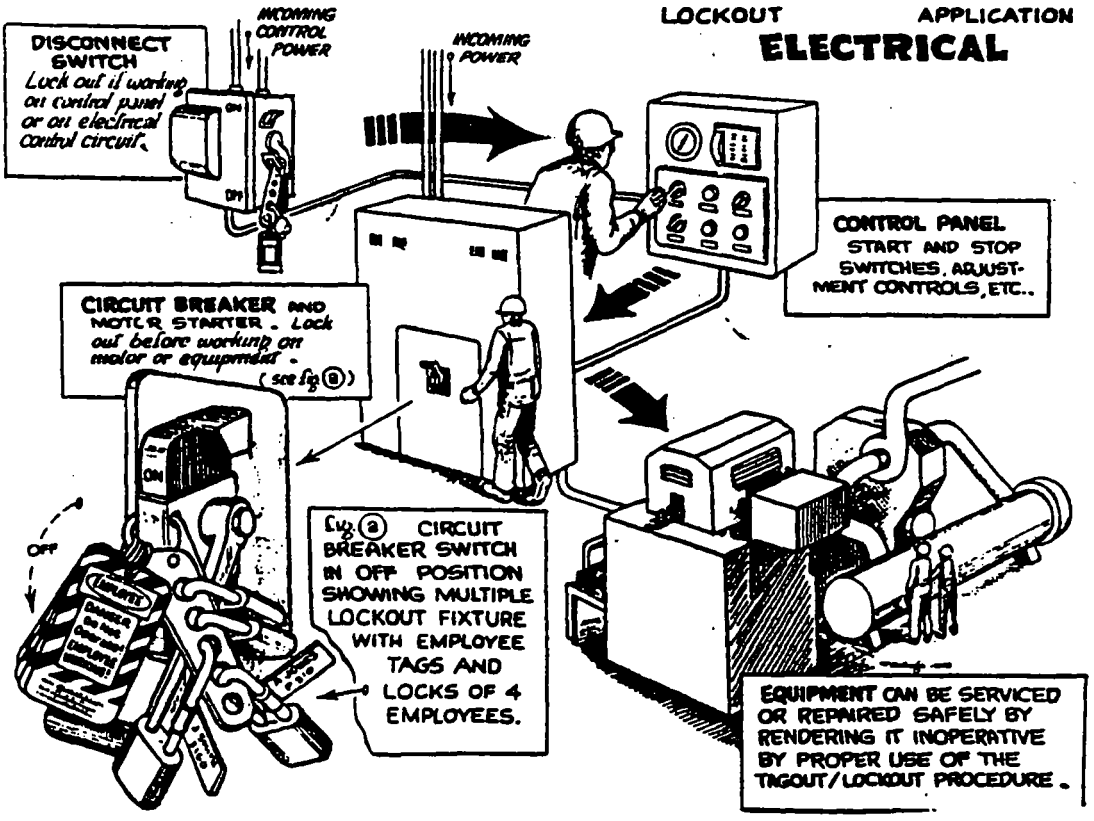


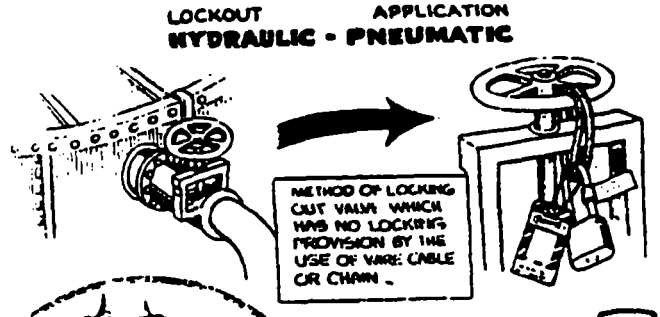
MIOSHA/SAFETY EDUCATION & TRAINING DIVISION

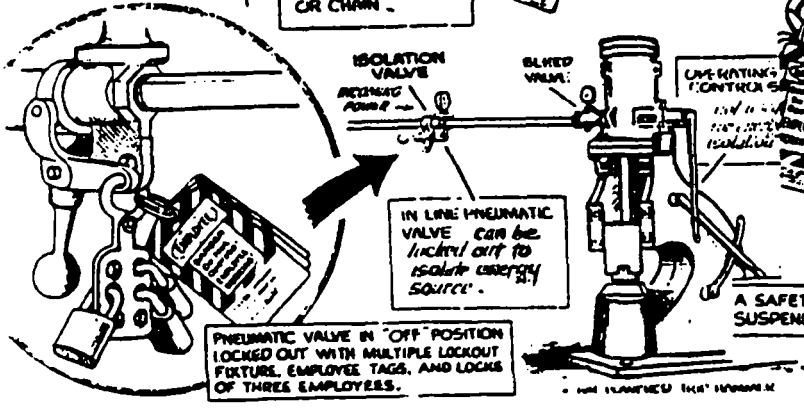
On-Site Consultation Abatement Method Advice For:

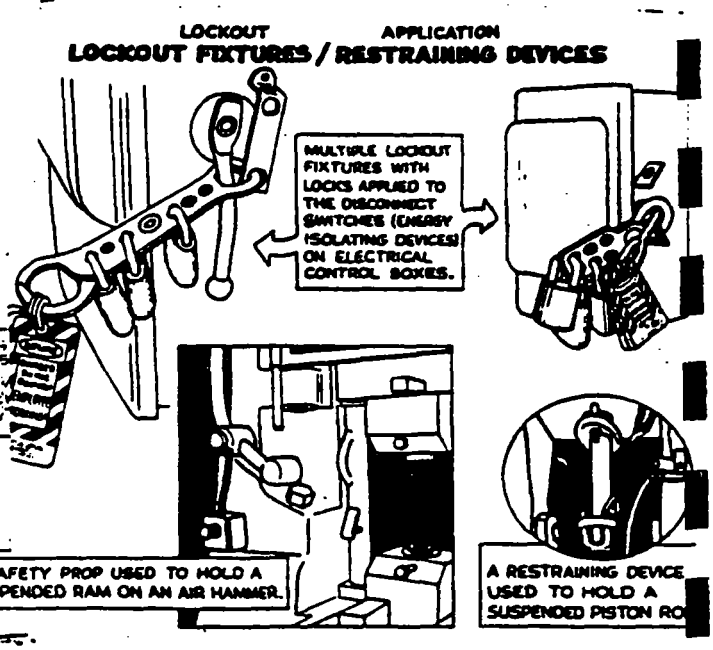
LOCKOUT PROCEDURES

LOCK-OUTS II









6. Air testing or monitoring is performed before entry into every confined space. State and federal laws call for air testing to determine:

   A. Oxygen level - An oxygen level below 19.5% is considered to be Immediately Dangerous to Life or Health (IDLH). Great Lakes Environmental Services requires workers entering an IDLH atmosphere to use a positive pressure/demand self contained breathing apparatus (SCBA) such as a Scott Air Pak or the on-line Scott Ska-Pak with five minute egress bottle (see Respiratory Protection Section of this Safety Manual for full information).

   B. Combustible gas level - A combustible gas level at or above 20% of the lower explosive limit (LEL) is considered to be an IDLH atmosphere (see definitions earlier in this section). In addition to the respiratory protection requirements for all IDLH atmospheres, you must also try to reduce the % LEL to a safer level and limit entry to the minimum number of employees required to reduce the hazard (reduce the LEL). Non-sparking tools and other fire precautions must also be used.

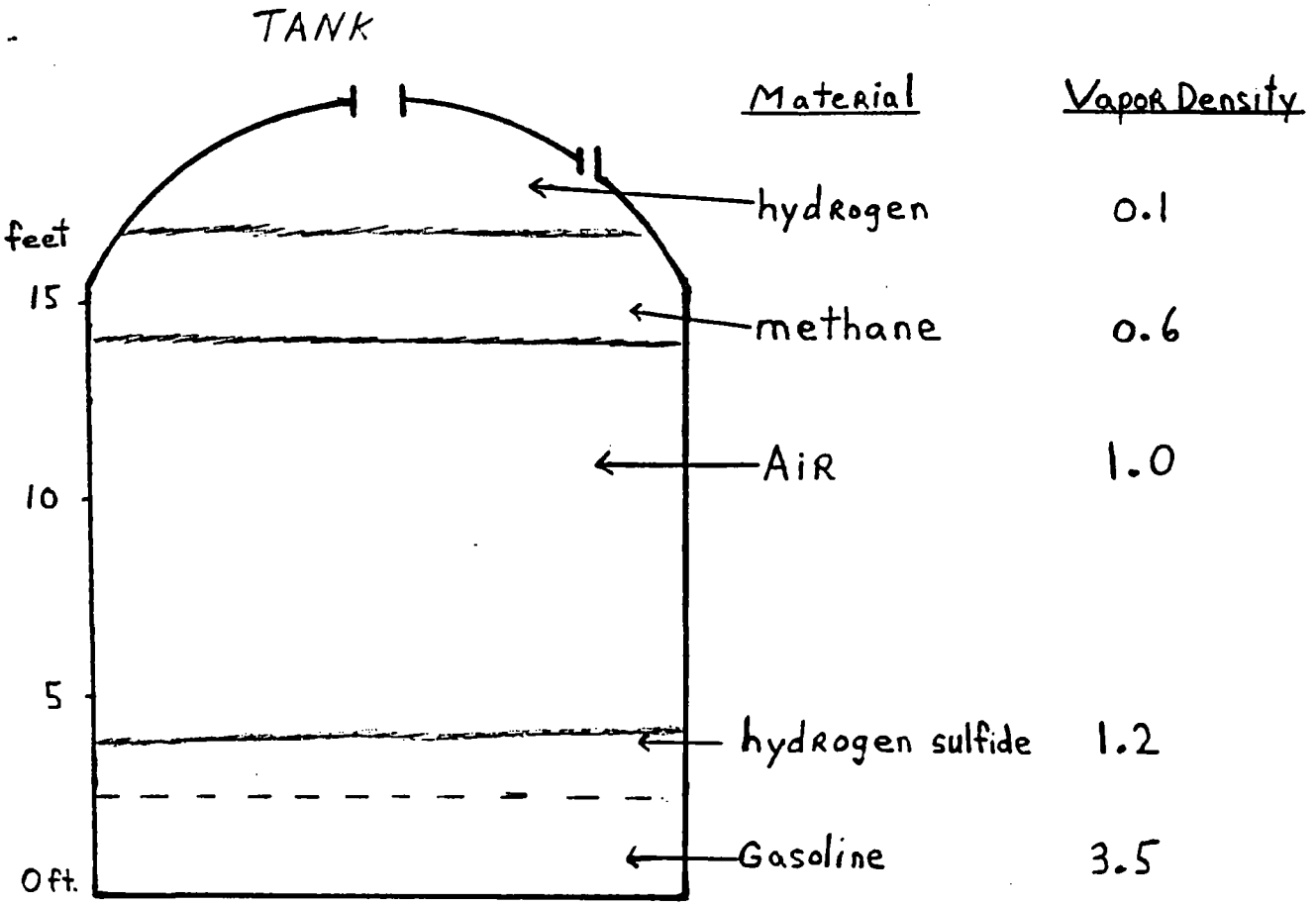
   C. Toxic gases - A toxic gas is a gas present at or above published permissible exposure levels (PELs). The most common toxic gases that can be tested for in the field are hydrogen sulfide (H_2S) and carbon monoxide (CO). Measurement problems exist because there are hundreds of other toxic gases, some of which have not been given defined permissible exposure limits. Some of the toxic gases that have been assigned PELs have also been assigned IDLH levels. Toxic gases are usually measured in units of number of parts per million of the gas in fresh air (ppm) and/or milligrams of the gas per cubic meter of fresh air (mg/m^3). A false sense of security can be created by just testing for hydrogen sulfide or carbon monoxide and assuming that an atmosphere that passes these tests is free of toxic gases.

Great Lakes Environmental Services uses a GasTech combination combustible gas/oxygen deficiency portable detector to check for LEL % and % oxygen. Full instructions for use and maintenance are supplied on the following pages. Calibration information is provided for your general understanding but is to be performed only by trained designated technicians. Our units are equipped with extender cables so the sensing unit can be lowered into a confined space and the air checked at several levels.

You want to be careful to check the air in a confined space at several different locations where possible different gases have different weights or vapor densities, some are heavier than air and some are lighter. Gases can layer in a poorly ventilated space i.e.,

Continue...

Vapor Layering



If you were to only test at the five feet level you could get a reading that says only normal good air is present. That could be a fatal mistake.

- Test at several different levels in the confined space. Test through more than one opening if possible so that you can check more than one area of the tank.

- Be careful to keep the sensing element on the bottom of the detector or at the end of the extender line (if used) out of liquid or sludge. The sensing units can be plugged up or ruined by liquids and crud.

- Repeat the tests frequently during the work period because work in a space can change the air quality.

- Oxygen level test results 20.5% O_2 Time 8:15 AM
  Combustible gas test results 3% LEL
  Comments: treat as IDLH because of oil sludge H_2S problem

  Signature of Tester X I. M. Taff

Toxicity testing may be performed on a case by case basis. On some jobs Great Lakes Environmental Services will employ an industrial hygienist to monitor toxic air contaminants. On some jobs we may purchase or rent equipment or devices to test or monitor for some known or suspected contaminant such as carbon monoxide or hydrogen sulfide. In general, however, we will not perform toxic air testing due to the limited abilities of the equipment available and the false sense of safety that can be created.

8. Great Lakes Environmental Services has a built large safety factor into our confined space program largely because of the toxicity testing problem. We require our entry personnel to prepare for the worst case. Based on the chemical nature of the material in the confined space, LEL %, and Oxygen %, Great Lakes Environmental Services uses either pressure/demand SCBA or constant flow positive pressure supplied air respiratory protection. Safety harness, safety lines, and outside safety monitors are used for every entry.

   - If the chemical contents of the space are or were dangerous or of a largely unknown nature, Great Lakes Environmental Services will treat the confined space as having an IDLH atmosphere even if LEL and oxygen read okay.

Continue...

- If the contents of the space are well defined and of a low hazard nature (e.g., antifreeze) and LEL % and Oxygen % read okay, Great Lakes Environmental Services will allow use of continuous flow positive pressure supplied air respiratory protection. All other safety requirements remain the same including permits, safety lines and harness, and outside safety monitors.

Respiratory protection requirements (required)

Positive Pressure Demand SCBA-Air Pak _____

Positive Pressure Demand SCBA on line with egress bottle X

Continuous Flow Supplied Ambient Air Mask (non-IDLH use only) _____

Comments: _____

An emergency self contained breathing apparatus must be kept immediately outside of the confined space. This would be used to equip a rescue person in an emergency. This will usually be a Scott Air Pak. The unit must be fully charged and in proper working order. The type and location should be indicated on the permit.

Emergency SCBA (positive pressure/demand) available immediately outside of the confined space. yes [X] no [ ]

Comments: stored in case next to cascade tanks

9. Protective clothing of some type is normally required for confined space entry work. You should refer to the "Personal Protective Equipment" section of this manual for details based on the nature of the material in each confined space.

Does the material require use of any special protective clothing?
yes [X] no [ ]

Describe: PVC Raingear or Plastic Coated Tyvek due to mess.

Continue...

10. The area around a confined space entry operation should be secured and posted to keep on-lookers and others from mistakenly entering the confined space and from disturbing equipment (safety lines, air lines, etc) being used to support the confined space crew. Warning tapes, ropes, barricades, etc can be used for establishing a perimeter around the work area. A confined space entry warning sign (and a copy of this completed permit) must be kept visible near the entrance to the confined space. Additional warning signs can be posted on the perimeter to reduce gawkers. Safety monitors must keep their attention on their buddy (entry person) and cannot stop to chit-chat with gawkers.

    Area has been secured (ropes, barricade tape, etc). yes [X] no [ ]

    Confined space warning sign posted. yes [X] no [ ]

11. Lighting is often poor in confined spaces. Frequently additional lighting must be provided. Care must be taken to avoid bringing severe hazards such as electrocution or sparking into a confined space with the lighting.

    - Lighting used in confined spaces with an LEL reading of 10% or greater must be of an approved (e.g., Underwriters Laboratory-U.L.) explosion proof design (intrinsically safe).
    - All electrical cords must be of a heavy duty and grounded design.
    - All electrical cords must be in good repair i.e., no bared wires, ripped insulation, etc.
    - Ground fault circuit interrupters (GFIs) should be used as added protection against electrical shorts. A ground fault circuit interrupter will automatically stop sending power to a line or light that has shorted out. Once the shorted wire has been repaired or replaced the GFI can be easily reset.
    - Low voltage lights (e.g., 12 volt) may be used in some situations to reduce electrical hazards.
    - All lights used in confined spaces must have their bulbs and electrical components protected from impact and water damage.
    - Lights shall not be simply hung by their electrical cords in a confined space unless specifically designed that way. Most suitable lights are designed to be hung from a hook at the top of the bulk globe protector.

Continue...

DANGER

CONFINED SPACE

SPECIAL PRECAUTIONS REQUIRED!
SEE AUTHORIZED PERSONNEL
BEFORE ENTRY.

MICHIGAN DEPT. OF LABOR • SET DIVISION

SET #2054

- When additional lighting is required to work safely in a confined space, a backup light must be immediately available to allow entry personnel to find their way out. Usually an explosion proof flash light kept at the exit will be adequate. However, if an entry person will be out of direct line of sight with the exit and artificial lighting is required, the entry person must have a flashlight suitable for use in the confined space in the event if supplied light failure.

  - Will additional lighting be required inside confined space?
    yes [X] no [ ]

  Type: Explosion proof _____ Low voltage _____ other 110 with GFI X

12. Communication between entry personnel and safety monitors is required and can be accomplished in several ways. Signals must be agreed on and understood in order to be effective. Each buddy team must discuss their signals before each entry.

    Visual - if safety monitor and entry person are always in direct line of sight with each other visual signals can be used e.g.,

    - Thumbs Up "Come Out!" *or* "I am coming out!"
    - Crossed Hands "No" or "Stop"

    Radio/Voice - Intrinsically safe radio equipment that is designed for use with respiratory protection equipment can make communications much easier. The safety monitor and entry person can talk to each other. However, this talk must be kept short and to the point if more than one entry team is involved because the radio channel must be kept open for emergency messages. Our system should be used on "talk around" channel (like a local walkie-talkie) when used for confined space work. Workers should be addressed by specific name or number to avoid confusion. We have ear/mike units that adapt to our standard Motorola portable radios (see EM200 information on following pages). These units must be protected from dirt, water, sludge, etc as much as possible.

    Safety Line Pulls - All Great Lakes Environmental Services confined space entry workers are always attached by safety lines to their safety monitor. This line can be used for communication. A

Continue...

simple system of tugs can be used to convey most important information. The signals must be agreed upon between the monitor and the entry person.

Sample signals could be:

Safety Monitor	to	Entry Person
1 tug on line	means	Are you okay?
4 tugs on line	means	Come out now!

Entry Person	to	Safety Monitor
1 tug (answer)	means	I am okay
2 tugs	means	Give me slack
3 tugs	means	Take up slack
4 pulls	means	I'm coming out
2-2-2 pulls	means	I need help

Note to Safety Monitor - Do not let slack build up in the safety line going out or coming in. Always keep a light tension on the line!.

- Communications between entry person and safety monitor will be:

visual [ ] radio/voice [ ] safety line pulls [X]

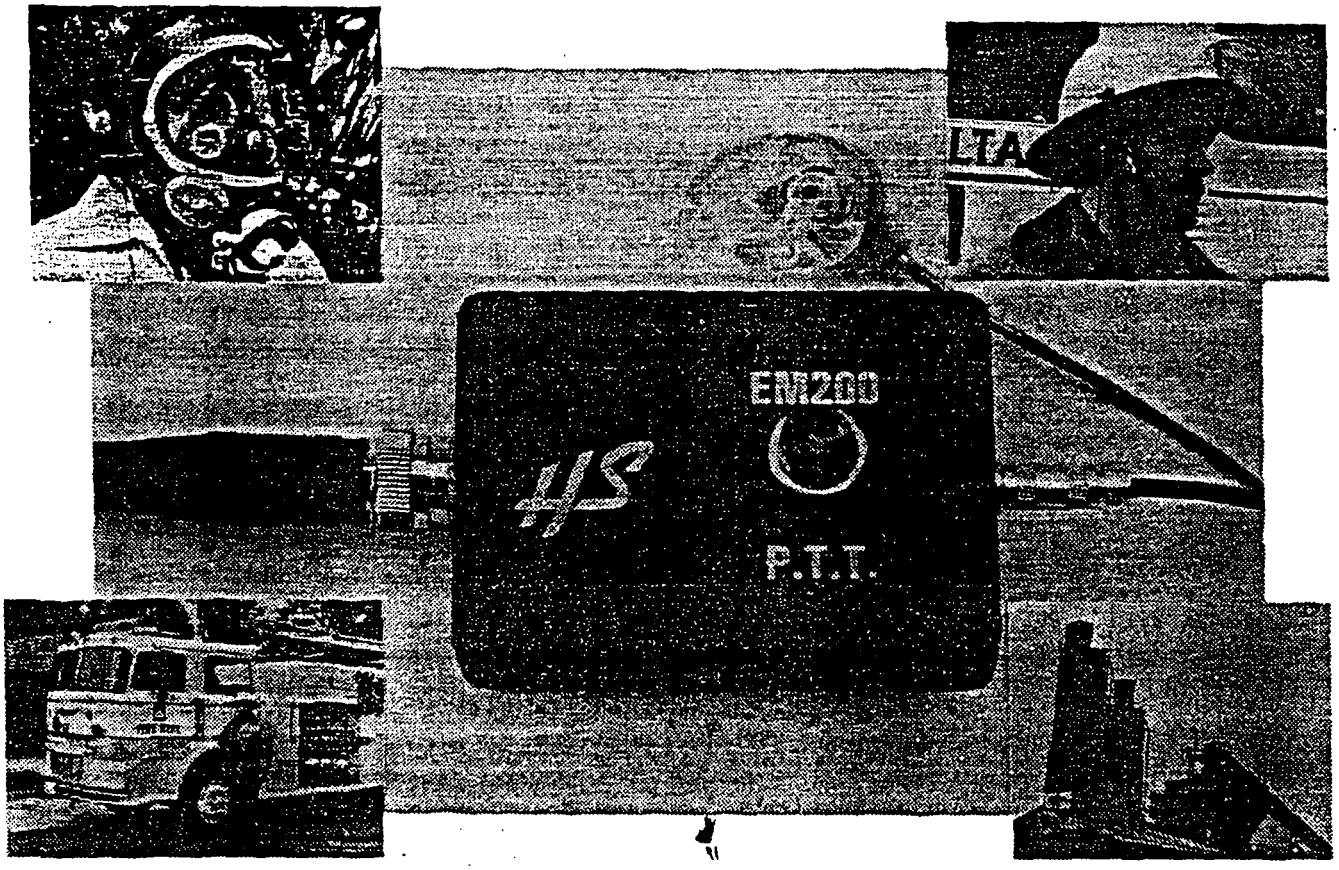
13. Special tools or equipment may be required to work safely in some spaces or with certain materials. Tools used in confined spaces with an LEL of 10% or more must be of a non-sparking variety (brass, beryllium, etc). Rubber or plastic coated tools may be needed in some situations where the materials is corrosive to metal. The possibilities are many. Consult your work order, and directions from supervision, and your knowledge of the material at hand. Describe any special precautions taken. Remember equipment such as steam cleaners and pressure washers should be grounded or bonded to the confined space surface to prevent static charge build ups and sparks in combustible atmosphere. Material Safety Data Sheets (MSDS) for cleaning products used are available on request.

- Is any special equipment (no spark tools, shovels, etc) required due to the nature of the contents or the LEL %? yes [X] no [ ]

Describe: Rope ladder and squeegees

Continue...

EM 200
EAR-MIKE
TRANSDUCER



EAR-MIKE
"An Ear Microphone/Speaker in one"

- A microphone that is worn in the ear and is also a speaker
- Works with any two way radio equipped with external speaker/ microphone capability
- "Push to Talk" switch on interface module allows hands free two way communication (standard feature)
- "Push to Talk" can be worn anywhere on the body
- Wear under protective clothing, head gear, breathing apparatus and maintain hands free two way communication
- Ideal in high ambient noise environments - ear protectors shield microphone and speaker.

EAR-MIKE

"An Ear Microphone/Speaker In One"

DESCRIPTION:

The EAR-MIKE is a Transducer which combines the functions of a Microphone with that of a Speaker in a unit as small as a hearing aid. Connected to a Push To Talk (PTT) switch on a compact interface unit, the EAR-MIKE can be used with any radio equipped with an external Speaker/Microphone capability.

Transmission is achieved by using the vibrations created by the Voice box and eardrum which are then picked up in the ear canal. Reception is accomplished as with a conventional earphone.

IMPORTANT FEATURES:

- **Ideal in High Ambient Noise environments when worn with ear protectors.**
- **P.T.T. switch (standard feature) allows hands free communications.**
- **Sound reproduction has excellent detail even when user is whispering.**
- **Ideal for extreme cold, all radio gear worn inside clothing.**

APPLICATIONS:

- Motor Cycle Police
- Police ERT
- Fire Fighters
- Aircraft Ground Crew
- Heavy Equipment Operators
- Private Security
- Military
- Prison Guards
- Oil Industry
- Mining
- Construction
- Power Generation
- Power Transmission
- Railyards
- Helicopters
- Many More

EM-200 STANDARD EQUIPMENT:

- Transducer & Cord
- Interface Module
- Interface Connector
- Molded Earpiece
- Battery

OPERATING INSTRUCTIONS:

- Connect Interface cable to Radio
- Attach Interface module to a convenient place on your body.
- Insert EAR-MIKE in ear and plug cord into Interface Module.
- Turn on radio - Set volume and Squelch EAR-MIKE is now ready for use.

WARRANTY:

All EM-200 Transducers are warranteed for one year against defects in workmanship and materials. This does not include damage caused by misuse and specifically excludes cable assemblies. No other warranties are expressed or implied.

EAR-MIKE BUILT TO INTRINSICALLY SAFE SPECIFICATIONS:

- All external connectors are to MILITARY Specs, and allow no outside access.
- Interface connector - Screw type, 6 pin.
- Transducer cord connector - miniature plug with safety catch will not pull out accidentally.
- Interface Module Casing - DIE-CAST ZINC per intrinsically safe spec.
- PTT switch fully encapsulated and sealed.
- Fully enclosed electronics.

FEATURES:

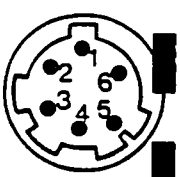
- Weather resistant.
- Baked Black Powdered finish.
- Back plate with belt clip can be adjusted for right or left mounting.

SPECIFICATIONS:

- **Rx Input Impedance** - 22K ohm Nom. @ 1 Khz
- **Tx Output Impedance** - 1K ohm Nom.
- **Signal/Noise Tx Audio** - greater than 60 db
- **Frequency Response Tx Audio** - + 1 db, 50 hz - 10 Khz
- **Size** - 77 x 55 x 21 mm
  3.1 x 2.2 x .8 inch
- **Battery** - AA 1.5 volt
- **Battery Drain** - Tx (P.T.T. Depressed) Less than 1.8 Ma
- **Weight** - 300 gram (10 oz.)

INTERFACE CONNECTIONS:

FRONT



- Pin 1 - RX Audio
- Pin 2 - TX Audio
- Pin 3 - P.T.T.
- Pin 4 - Ground
- Pin 5 - Spare
- Pin 6 - Spare

ADJUSTABLE:

- For optimum voice clarity internal adjustment is easily accomplished.

World Wide Distributors:

MAGNUM DISTRIBUTION LTD.
102 - 11400 BRIDGEPORT RD.
RICHMOND, B.C. V6X 1T4
CANADA

MAGNUM DISTRIBUTION INC.
P.O. BOX 8008
BLAINE, WASH. 98230
U.S.A.

TEL: (604) 270-1389 TELEX: 04-355889 (MAGNUM)

Authorized Dealer:

EM-200 EAR-MIKE GENERAL INFORMATION

INTERFACE CABLE

If you wish to make your own cable, ask your EAR-MIKE Sales Rep to provide you with the pin connections required for your radio; he has this information for most of the commonly used portables. If your radio is not listed, he will contact our technical department for you. Any technical information you can provide (radio schematics, etc.) will help speed the process.

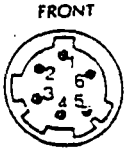
When making up interface cables please be extremely careful that the wires are connected to the correct pins.

PIN/SIGNAL ASSIGNMENT

Following is the pin/signal assignment for the 6 pin interface connector which connects to the EM-200 end of the radio interface cable.

Numbering as seen from the FRONT of the connector (NOTE - when making the connections at the BACK of the plug read the pin numbers CLOCKWISE).

FRONT



PIN 1 - Receive Audio (speaker)
2 - Transmit Audio (mic)
3 - Push to Talk (PTT)
4 - Ground
5 & 6 - Spare

After the cable is completed, and before it is connected to the radio and EAR-MIKE, it is good practice to verify the connections with an Ohm Meter. When doing this, first check for the correct pin connection and then check for possible short circuits by touching every other pin as well as the right one.

TUNING THE GAIN

EAR-MIKEs are a totally new technology and require a new approach. Traditional microphones require a setting of 4 - 5 K.C. on a sine wave to get correct deviation. This DOES NOT apply to EAR-MIKE transducers. A setting that high causes "clipping or choking" and will not go through repeaters. Also, the sound quality will not be good. For best results DO NOT set with scope or meter.

PLEASE ADJUST THE GAIN BY EAR ONLY IN THE FOLLOWING MANNER:

1) Connect EM-200 to one radio; INSERT MIKE IN EAR.
2) Remove rubber plug from side wall of module to expose potentiometer screw.
3) Set second (receive) radio, 5 - 6 feet away. Do not apply an EAR-MIKE on this radio.
4) Set volume of second radio to half.

2....

5) Place EAR-MIKE transducer in your ear as per instructions under "Fitting Ear Insert".
6) Push and hold P.T.T. on interface module. The ultimate setting is just below the feed-back threshold.
   a) If feed-back squeal is present from receiving radio: turn potentiometer slowly until squeal just disappears. Try clockwise first.
   b) If no feed-back squeal present from receiving radio: turn potentiometer slowly until squeal appears then back off slightly till it just disappears. Try counter-clockwise first.
7) Transmit by normal voice and if clear and crisp, whisper. If whisper is clear, EAR-MIKE is now properly set. If not, repeat step 6.
8) The unit is now capable of working in close proximity with other radios and will also operate correctly through repeaters.

FITTING EAR INSERT

When the EAR-MIKE is connected to the radio and you are putting the Transducer/Ear Mold into your ear, make sure that the horn (pointed piece) of the ear mold is behind the skin flap at the front of the ear. This will ensure that the ear mold will stay put. Ear Inserts are also available in left or right; small, medium or large.

BATTERY

The 1.5V battery is only in use when the P.T.T. switch is actually pressed. Factory states that under normal usage conditions, the battery should last for approximately one year. For safety, we recommend replacing the battery every six months.

BELT CLIP

The belt clip can be set for right or left side attachement by simply removing the backplate and turning it 180 degrees.

14. "Hot Work" is defined as any work involving burning, welding, riveting, or similar fire or spark producing operations, as well as work which produces a source of ignition, such as drilling, abrasive blasting, and space heating, etc. Hot work is more hazardous when performed in confined spaces because:

- fire/explosion hazards in combustible atmosphere
- increased noise level
- air contaminants created by the hot work e.g., welding fumes and carbon monoxide from gasoline engines
- oxygen depletion (use up) in the confined space
- you have less room for error and only limited escape

Hot work is not to be performed in a confined space unless a hot work permit is completed and:

- atmosphere in the confined space is kept below 5% LEL
- entry personnel must use pressure/demand SCBA (Air Pak or Ska Pak)
- suitable fire extinguisher must be immediately available
- safety monitors must monitor for fire hazards and alert entry personnel of any changes
- ventilation shall be used to remove hot work fumes, dusts, gases, etc from the confined space if it can be performed safely
- compressed gas cylinders (other than breathing air) are not to be taken into the contained space
- all other standard precautions for cutting, grinding, welding, etc are used including eye and face protection, grounding, bonding, etc.
- all other confined space entry/work requirements are met and maintained as per the confined space permit and company procedures

Will "Hot Work" requiring a permit be performed on or in the confined space? (if yes - attach permit) yes [ ] no [X]

Continue...

GREAT LAKES ENVIRONMENTAL SERVICES

Hot Work Permit for Confined Spaces

Job name_____ Job No._____

Location_____

Person authorized to perform "hot work"_____

Purpose:_____

Equipment to be used:_____

_____

Materials to be used:_____

_____

Procedures to be used:_____

_____

What effect will hot work activities have on the confined space hazards?_____

_____

List any special precautions to be taken:_____

_____

% LEL_____ Time_____ Tester Signature _____

(5% is maximum LEL allowable for hot work in confined spaces)

Suitable charged fire extinguisher is immediately available:_____

I have personally inspected the work site, entry permit, and proposed hot work and hereby authorize the above named employee(s) to perform the hot work described. This form shall be attached to the confined space entry permit for this job.

name (on the job supervisor or crew leader):_____

signature:_____ time_____

this permit expires at:_____

Comments:_____

_____

_____

_____

15. The buddy system provides the safest way to protect confined space entry workers. A safety monitor (backup man) is assigned to each entry person. The safety monitor's job is to watch over and protect his assigned entry person. The safety monitor must:

- know the entry permit requirements and conditions
- know emergency signals and sources of aid
- know how to use all respiratory protection equipment being used or available for emergency use
- wear appropriate personal & respiratory protection equipment to protect himself from any hazards at or near the entrance to the confined space
- check over the assigned entry person's safety gear (suits, harnesses, air lines, etc) to ensure that it is properly worn and in good working order before allowing entry
- know how to shut down any equipment being used in the confined space but supplied or powered from outside e.g., pressure washer, air tools, etc.
- assist the entry person in and out of the confined space
- tend the safety line for the entry person always keeping a slight tension on the line
- keep a constant watch over the entry person and conditions in the work area
- maintain communications with the entry person
- signal the entry person to exit the confined space if any problems or unusual conditions develop in the confined space or in the area near the entrance to the space
- never leave the entry person unattended while he's in the confined space except to get medical or rescue aid for the entry person in an emergency and if other methods of obtaining aid have failed
- Never enter the confined space <u>except in a required and planned emergency rescue attempt</u> after all alarms have been sounded, emergency rescue medical help is en route, and no other means of rescue are workable. Full personal protective gear including SCBA, harness and safety line must be used and an employee aware of the permit location, knows who is in the confined space, and knows the nature of the problem must remain outside the space to direct rescue and medical emergency personnel when they arrive.

The entry person must respond to the direction and communications of the safety monitor. Each buddy must respect the duties and responsibilities of the other and work as a team. If the entry person gets

Continue...

confused or thinks that signals are getting crossed he should exit the confined space, talk over and resolve the problems with his safety monitor.

The Great Lakes Environmental Services entry permit requires each buddy team to sign the entry permit individually to document that they know who they are working with and are responsible for.

- A safety monitor has been assigned to each individual entering the confined space. Each pair of buddies must sign below: yes [X] no [ ]

Entry Person	- with -	Safety Monitor
1. Sam Sludge		1. Red C. Ross
2.		2.
3.		3.

16. Great Lakes Environmental Services requires that entry persons wear a full body harness and a secured safety line for each confined space entry. The purpose of this requirement is to allow for rescue without having to send someone into a confined space. Also, in the event that a worker was trapped in a confined space, rescue workers could follow the safety line to the trapped worker.

One end of the safety line is attached to a D ring [or sometimes to a short lanyard (shock line) which is attached to the D ring] on the upper center part of the back of the harness. The other end must be be secured to a solid object or retrieval device located outside of the confined space.

Full body harnesses are required for all confined space entry. Waist belts are not acceptable because an unconscious person would bend at the waist (double over) and could be hard or impossible to pull through an access hatch. The full body harness also secures to the legs of a worker and makes it nearly impossible for an unconscious worker to slip out of the harness as could be possible with a simple chest harness.

For narrow access hatches wristlets connected to a safety line should be worn. The wristlets are designed to pull the hands and arms up over the head of an unconscious worker in order to make it easier to get the worker out through a narrow hatch. NIOSH recommends "If the the exit opening is less than 18 inches in diameter, then a wrist

Continue...

type harness shall be used". (Criteria For a Recommended Standard - Working In Confined Spaces - 1979). The wristlets must be used with a full body harness and not in place of the harness.

A variety of tripod or gantry supported rescue/recovery life line and winch type systems are becoming available. These systems are designed to make it safer to lift an entry person out of a confined space. There are problems in matching the device and its' supports to the conditions at the entrance to each confined space and in finding non-sparking and/or chemically resistant materials. This information is provided as a general introduction to mechanically assisted rescue devices. Specific product information will be provided when we obtain our systems.

- Each entry person is wearing a full body harness (and wristlets for narrow openings) and a secured safety line. Extras are available for emergency use. yes [X] no [ ]

Continue...

FEDERAL REGULATIONS & SPECIFICATIONS

OSHA ■ OCCUPATIONAL SAFETY & HEALTH ACT

The products MILLER manufactures are covered primarily in three paragraphs of the OCCUPATIONAL SAFETY AND HEALTH ACT. The specification for materials and construction are given in the Safety and Health Regulations for Construction, Title 29, Chapter XVII Part 1926.

SAFETY BELTS, LANYARDS AND DROP LINES are covered in Part 1926.104. This paragraph spells out the minimum requirements of life lines, lanyards for safety belts, and safety belts and lanyard hardware. No reference is made to safety belt or harness construction, materials used in them, nor the testing of them as a completed unit as of the date of this catalog.

Equipment manufactured by MILLER will meet the requirements of Part 1926.104 on the date of shipment from the point of manufacture.

SAFETY NETS are covered under the same Title and Chapter Part 1926.105. The act is a little bit more specific concerning safety nets. This section was primarily written around ANSI standard A10.11 on safety nets and does include construction dimensions and a performance test together with evidence of proof of test. MILLER safety nets will meet the requirements of 1926.105 on the date of shipment from the point of manufacture.

LINEMEN'S BODY BELTS AND SAFETY STRAPS are covered under the same Title and Chapter Part 1926.951 (b) and Part 1926.959. Life lines and lanyards for electric utilities are listed under 1926.951 (b) (4) (i). This section states that life lines and lanyards shall comply with 1926.104 referenced above. The main section covering body belts and safety straps is 1926.959. MILLER body belts and safety straps will meet the requirements of this paragraph on date of shipment from point of manufacture. Part 1926.556 covers aerial lifts and is referenced in Part 1926.952 (b). Part 1926.556 (b) (2) (v) states: "a body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift."

It is important to note that the mandatory use of safety belts, lanyards, life lines and safety nets are referenced throughout the various parts of the act. This information is furnished upon request.

ANSI ■ AMERICAN NATIONAL STANDARDS INSTITUTE

SAFETY LIFE NETS

A10.11 is the ANSI standard covering safety life nets. MILLER will certify that the nets MILLER manufactures will meet this standard at the time of shipment.

All nets are dated and numbered in accordance with A10.11. Safety nets are required where persons are working 25 or more feet above ground, water or machinery or other solid surfaces and are not otherwise protected by safety belts and lanyards, scaffolds or other working surfaces not properly guarded in compliance with other applicable ANSI standards. They are also required where public traffic or workers are permitted beneath the work area and are not otherwise protected from falling objects. In such cases, nets shall be lined with a mesh of size and strength sufficient to contain tools and materials capable of causing injury.

All nets shall be identified with name of manufacturer, identity of net material, date of manufacture, date of prototype test, and name of testing agency. This standard also requires an on-the-job test after net has been installed and before use and at 6 month intervals thereafter. Copies of this standard are available upon request.

SAFETY BELTS, HARNESSES, LANYARDS

A10.14 is the ANSI standard for construction and industrial safety belts, harnesses, lanyards and drop lines. This standard lists the various types of safety belts and lanyards for the jobs required by classification. These classifications are as follows:

Class 1: BODY BELTS (WORK BELTS).
Used to restrain a man in a hazardous position and to reduce the possibility of falls.

Class 2: CHEST HARNESSES.
Used where there is only limited fall hazard (no vertical free fall hazard), retrieving persons such as removal of persons from a tank or bin.

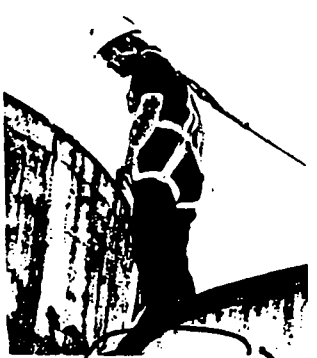
Class 3: BODY HARNESSES (PARACHUTE TYPE).
Used to arrest the most severe free fall.

Class 4: SUSPENSION BELTS.
Independent work support used to suspend a worker, such as bo's'n chairs, tree trimmer's belts or raising or lowering harnesses.

Regarding lanyards, the standard states that they shall be kept as short as possible to minimize the length of a free fall. The test requirements state that body belts (Class 1) with their associated lanyards when subjected to a fall shall produce a stopping force not more than 10 times gravity. Body harnesses (Class 3) and their associated lanyards when subjected to a fall shall produce a stopping force of not more than 35 times gravity. The standard further states that each belt and lanyard assembly shall be stamped with the date of manufacture, manufacturer's name and the number of this standard. It further states that each belt and lanyard assembly shall be visually inspected before each use and further inspected in accordance with manufacturer's recommendations not less than twice annually. Copies of this standard available upon request.


Class 1


Class 2


Class 3


Class 4

APPENDIX C

SAMPLING EQUIPMENT AND

PROCEDURE LISTING

SAMPLING EQUIPMENT AND PROCEDURE

Sampling a Drum

Drums containing liquid wastes can be under pressure or vacuum. A bulging drum usually indicates that it is under high pressure and should not be sampled until the pressure can be safely relieved. A heavily corroded or rusted drum can readily rupture and spill its contents when disturbed; it should only be sampled with extreme caution. Opening the bung of drum can produce a spark that might detonate an explosive gas mixture in the drum. This situation is difficult to predict and must be taken into consideration every time a drum is opened. The need for full protective sampling equipment cannot be overemphasized when sampling a drum.

0.5 Storage drums properly prior to sampling.

1. Position the drum so that the bung is up (drums with the bung on the end should be positioned upright; drums with bungs on the side should be laid on its side, with the bungs up).

1.5 Any standing water or other material should be removed from drum top, this prevents contamination to the sample and will prevent water contacting a sample which may possibly be water reactive.

2. Allow the contents of the drum to settle.

3. Slowly loosen the bung with a wrench, allowing any gas pressure to release.

4. Remove the bung and collect a sample through the bung hole with a thief sampler.

5. When there is more than one drum of waste at a site, segregate and sample the drums according to waste types.

Sampling a bulk storage tank

Physical dexterity is required to sample a tank since most tank holes are on the top of a tank. A sampler must be able to climb up the tank while wearing required safety equipment and carrying sampling equipment. Two people are required to sample a tank. The first person collects the sample while the other person stands back near the sampling hole, ready to assist or call for help if the need arises.

If the tank is corroded, samplers should not attempt to climb on the tank, an aerial lift shop will be used instead.

Procedures

One sample from the upper, middle, and lower sections will be collected from the tank contents with a Kemmerea sampler.

The samples will be placed in one container and submitted as a composite sample.

DRUM SAMPLING

GENERATOR ______________________ DATE ____________

JOB # ______________________ PAGE ____ OF ____

DRUM#	DESCRIPTION	L/S	OVER PAK	TOP	RING	BUNG	QUANTITY	P/N

APPENDIX D

SAMPLES SCREENING PROCEDURE

SAMPLE SCREENING PROCEDURES

FLAMMABILITY

1. Place approximately 5-10 ml of representative sample into a disposable beaker. Pass an open flame across the top, if the fumes flash or ignite that material has a flashpoint equal to the ambient room temperature.

2. By using a glass or metal container and either heating or cooling the sample and measuring the temperature prior to introducing an open flame an approximate flash range could be established.

   eg. A sample with a flashpoint of 115 can be heated to approximately 125 measuring the temperature with a thermometer, getting a flash at that temperature. The sample will cool measuring the temperature until it reached approximately 110 at which point it won't flash. The flashpoint would be somewhere between 110 and 125 so a quick categorization as combustible can be made.

3. If the sample doesn't flash at room temperature a flame can be touched directly to the material, if the flame flares the material probably is combustible or has a flashpoint between 90 and 140 .

4. If a sample doesn't flash at room temperature or flare on contact with a direct flame the material probably has a flashpoint >140 .

pH

1. For aqueous solutions pH paper is very reliable and easy to use in obtaining a rough estimate of pH.

2. For very dark colored material the color of the sample may block out or disrupt the coloring code of the paper. The material may be diluted with water to lighten the sample in order to get a readable color change from the paper. The pH might be as accurate but a readable pH reaction will allow a general characterization as basic or acidic.

3. pH paper has a very limited value in testing organic material. Usually the organic sample will either transfer its own color to the paper or wet the paper leaving the color of the paper itself as a reading. A pH meter of some kind would give a better reading.

4. Strength of an acid is very important in determining appropriate disposal options. A general test to determine whether landfill or neutralization is the best option is the use of 50% caustic test. A 5-10 ml sample is placed behind some protective shield, a 50% solution of sodium hydroxide is then slowly added. Any smoking, splattering, or bubbling

should be notes as well as a temperature rise that goes much above 150 . This is the exact test used by disposal sites and if any of the above reactions occur the acid probably won't be accepted for landfill.

ORGANIC

1. Fill a clear container with water, the sample should be added slowly watching to see if the material sinks, floats, or mixes freely with the water. Generally if the material maintains its integrity and sinks or floats the material is organic.

2. Specific gravity can also be estimated form the above procedure. If the material floats it will have some specific gravity below 1. If it sinks the specific gravity probably is greater than 1.

3. The white sorbants we use repel water and readily soak up organic material. Slowly put a small volume of sample onto a sorbent pad, if the material is soaked up it is organic. If the material beads or puddles without soaking in it is probably aqueous. Material that has an organic that might be soluble in water or a mix of some sort usually soaks in but not as quick or complete.

CHLORINATED

1. A sample of the material (liquid) can be added to water. If the material sinks to the bottom there is a good chance its chlorinated.

2. Pass an open flame over the top of a sample. If the smoke becomes dark black, if the flame flutters and goes out as the flame is lowered towards the sample, or if the bottom of the flame gets a green shade, a chlorinated solvent is probably present.

3. Using a stirring rod pass a sample through or around the edge of a flame, if a green flame occurs chlorine is present. A disposable pipet should be filled with sample then emptied. Next squeeze the pipet gently blowing fumes from the material through and around an open flame. Once again, a green color signifies chlorination.

SULFIDES

1. If a material has a very high sulfide concentration usually odor will be a key indicator with a rotten egg or swampy smell.

2. Lead acetate test strips can also be used to test for the presence of sulfides. A 5-10 ml sample should be mixed very carefully with an equal amount of 4:1 solution of hydrochloric acid. A white lead acetate test strip is suspended over but not touching the sample and some type of lid is placed on top to keep the hydrogen sulfide gas inside. If the test strip turned brown after a 1-5 minute time period there are sulfides present. Speed and degree of color change is an indication of concentration but further analytical results may be required.

PEROXIDE

1. Test strips for peroxides are used on samples of ethers and other known peroxide formers in order to ensure safety and a lack of peroxide crystals. The test strip is dipped into the sample then air-dried for 1 minute. (Breathing on the moistened strip is suggested) A color key on the test strip container codes for varying concentrations of peroxide crystals.

2. Sodium metabisulfite dissolved in water can be used to neutralize peroxide crystals. Copper may then be added to keep peroxides from reforming.

ISOCYANATES

1. Identifying isocyanates is generally quite simple because they react in a unique manner. A small sample of material can be mixed with about half as much ammonium hydroxide or ethylene diamine. Generally a change of color, production of heat, or bubbling and foaming signifies the presence of any isocyanate.

2. Even if the isocyanate is contaminated with another material or only makes up part of your sample this test usually will identify the isocyanate out. The isocyanate in the sample will react to cause a thickening or forming of solid but foremost the production of heat. If no reaction occurs there is no isocyanate present or the concentration low enough to disregard.

CYANIDE SPOT TEST

Reagents:

1. Chloramine - T solution - 1g In 100g or 100 ml water (prepare weekly)

2. Pyridine - barbituric acid reagent - add 6.0g barbituric acid in 100 ml volumetric flask - add just enough water to wet the barbituric - add 30 ml pyridine and mix - add 6 ml concentrated HCL mix and cool to room temperature - dilute to the mark and mix (prepare monthly).

Procedure:

To a test tube add six drops of sample and two drops Chlor-T solution and mix, add two drops pyridine - barbituric solution and mix - after one minute a pink to red color indicates 50 ppm or greater CN*

*Reference: U.S. EPA Guidance Manual

APPENDIX E

SITE CONTINGENCY PLAN

SITE CONTINGENCY PLAN

GREAT LAKES ENVIRONMENTAL SERVICES, INC.

Transportation Spill Contingency Plan

24-Hour Number (313) 758-0400

In the event of a spill of hazardous waste during transportation, the following actions must be taken and notifications made:

I. Take immediate action to protect human health and the environment.

A. Notify local authorities (police, fire, etc.).

The local authorities can take control of re-routing traffic, crowd control, fire prevention, ambulance, etc. Inform them of any know safety hazards, i.e., flammable, corrosive, etc.

B. Attempt to contain the spill by digging a dike, using sorbents, salvage drums, etc.

IMPORTANT - always consult your manifest and job order safety precautions before approaching a spill or lead. Do not approach the spill if you can not do so in a safe manner for the material involved. Use all of your safety gear. If you cannot approach safely, then dike downstream (direction the material will flow) from the spill direction and block off any pathways to streams, lakes, or storm drains.

II. Notify the home office at our 24 hour number **(313) 758-0400**

During normal office hours, you can call on the toll-free Michigan line 1-800-482-4484 or on the toll-free U.S. line 1-800-428-4482. If you call after hours on the 24-hour line (313) 758-0400, tell the telephone operator that it is any emergency and that you need to speak with your supervisor. Stay on the line while the answering service contacts a manager. When you speak with your supervisor or the responding manager, provide at least the following information:

Your name and location

Telephone number where you can be reached (this could be the local police telephone number)

What was spilled and how much

Any help that you need

Medical
Safety gear
Salvage drums
Additional truck, equipment, or people
Chemical information
Ambulance, tow trucks, etc.

II. Notify the home office at our 24 hour number **(313) 758-0400** (con't)

Manifest information

Material description
Generator name and telephone number
Disposal site name and telephone number

Agreed upon a time and method to re-contact each other within the next hour or two.

III. Great Lakes Environmental Services will have to clean up any hazardous waste spill that occurs during transportation or take such action as required by current environmental laws to remove any hazard to human health or the environment. Great Lakes Environmental Services has a firm commitment to reason in a responsible manner in order to protect the public the environment, our customers, and ourselves. In some cases, this could require calling in specialized subcontractors to assist us in a cleanup effort.

IV. Notification Requirements - In addition to handling the immediate problems, several federal and state agencies may require formal notification of any hazardous waste or hazardous materials releases. Failure to make a required notification can result in violations and fines.

A. Federal Notifications

The National Response center 1-800-424-8802 must be notified at the earliest practical moment of any of the following incidents:

1. An incident that occurs during the course of transportation in which as a direct result of hazardous materials or hazardous wastes:

   a. A person is killed
   b. A person received injuries requiring hospitalization
   c. Estimated property damage of $50,00.00
   d. A continuing danger exists in the judgement of the carrier even though a, b, or c do not apply

2. If a hazardous substance is spilled in a reportable quantity (R.Q.) from one package or transport vehicle into or upon the navigable waterways (includes any ditch or creek that connects to a larger river or lake) or adjoining shorelines, the person in charge of the vehicle shall notify the National Response Center at 1-800-424-8802.

B. Federal Information Requirements - Telephone Notifications

If notification is required to be made to the National Response Center due to any spill as described in 1 and 2 above, the following information will be required:

1. Name of the reporter

2. Name and address of carrier

   Great Lakes Environmental Services, Inc.
   22077 Mound Road
   Warren, MI 48091

3. Telephone number where reported can be contacted, i.e.

   (313) 758-0400

4. Date, time, and location of incident

5. The extent of injuries, if any

6. Material description

   a. Name (shipping name or manifest)
   b. Classification (DOT hazard class or manifest, e.g. ORM-E)
   c. Quantity spilled

7. A description of the type of incident (collision, rollover, etc.), nature of the hazardous material involvement (spilled, burned, etc.) and whether a continuing danger to life exists at the scene.

8. If there was a spill for a reportable quantity of a hazardous substance, we must also report the following:

   a. Name of the shipper (generator on the manifest)
   b. Quantity of the hazardous substance discharged, if known

   (NOTE: Hazardous substance and RQs are covered in Section I of this manual)

C. Federal Information Requirements - Written Report

CFR 49, Part 171.16 requires that a carrier who has an incident such as described in A-1 or A-2 involving hazardous material, hazardous wastes, or hazardous substances files a report in writing on DOT Form F5800.1 "Hazardous Materials Incident Report" within 15 days of the incident. A copy of this form is included at the end of this section.

If the incident involved a hazardous waste spill, we must also submit:

1. A photocopy of the hazardous waste manifest

2. An estimate of the quantity of waste removed from the scene, the name and address of the facility to which it was taken, and the manner of disposition of any unremoved waste must be entered in Par H (2 and 3) of the report form. Part H (2 and 3) must also be filled in if there was a spill of a reportable quantity of a hazardous substance.

The completed Hazardous Materials Incident Report must be sent in duplicate to:

Information Systems Manager
Materials Transportation Bureau
Department of Transportation
Washington, DC 20590

D. State Notifications - <u>In addition to Federal</u>

Our hazardous waste transporter permits in some states require us to notify a state environmental agency or emergency response number of <u>spills within their state</u>. In some cases, state have emergency assistance numbers which can provide technical assistance and coordination. When in doubt, it is best to notify the state involved. Great Lakes Environmental Services' main service are covers EPA Region V which includes Michigan, Ohio, Indiana, Illinois, Wisconsin, an Minnesota, so these states head up the list followed by Ontario and then the rest of the states we commonly travel to or through.

Michigan	1-800-292-4706
Ohio	1-800-282-9378 (in Ohio)
Ohio	1-614-224-0946
Indiana	1-317-633-0144
Wisconsin	1-608-266-3232
Minnesota	1-612-296-7373
Ontario	Ontario Provincial Police-Call the Operator and ask for Zenith 50000.
	MOE-calling within Ontario 1-800-268-6060 From outside Ontario 1-416-965-9619.

GREAT LAKES ENVIRONMENTAL SERVICES, INC.

Spill Kits

All Great Lakes Environmental Services' drivers are required to carry their standard safety equipment with them when transporting wastes. The drivers' basic equipment includes:

Hard Hat
Safety glasses
Face shield
Half face respirator - with organic vapor/acid gas and dust mist filter cartridges
PVC rain (splash) suit
Steel toe/shank chemical resistant boots
Chemical resistant gloves

Drum transport vehicles are required to carry a spill kit consisting of an 85-gallon salvage (overpack) drum containing:

1 bag floor dry
1 bale of sorbent pads
1 shovel (short handle)
1 broom (short handle)
1 disposable polycoated (yellow) tyvek suit
1 paid disposable boots
1 pair disposable gloves
1 packet of hazardous waste and DOT labels
duct tape
1 large visqueen bag

All Bulk vehicles used at the site will carry a supply of sorbent pads, a shovel, a bag of floor dry, some duct tape along with the drivers' standard safety equipment.

IMPORTANT REMINDER: Whenever approaching any spill, consider your safety first. Can you approach it safely with the materials you have on hand? Take some time to plan your action. Always leave yourself an out! Think, then act!

APPENDIX F

CHAIN OF CUSTODY

SECTION III

SAMPLE RECORDING AND PROCESSING -- CHAIN OF CUSTODY

All samples received in the laboratory are recorded on a two page work sheet. The original work sheet is maintained in the laboratory office for sample control and the duplicate stays with the sample until test completion.

At the office level, all samples are assigned a laboratory number and are entered into our in-house storage via floppy-disc, instant sample recall, and documentation of sample as to date, laboratory findings, and other pertinent data.

Upon receipt into the Chemistry Laboratory, the samples are recorded in a laboratory bound ledger along with all data concerning the sample. Laboratory data obtained from calculations in the ledger are transferred to the duplicate work sheet which is forwarded to the laboratory office upon completion. The samples are then recorded as being performed and typewritten reports are made from the laboratory work sheets. A complete analytical report will be furnished for each sample via computer with 48 hours upon test completion; thus allowing receipt of the original by the central office and/or the district originating the sample, within the allotted time. Upon competing, the analyst performing the test initials the laboratory copy of the finished report, indicating that the typist has accurately transferred all information from the laboratory work sheet. This is maintained in the laboratory files in conjunction with the duplicate work sheet.

Any discrepancy in the final reporting may be traced through the copy of the final repot, the laboratory work sheet, and the laboratory ledger containing all calculations. The logbook-ledger must be protected and kept in a safe place.

Chain of Custody

To establish the documentation necessary to trace sample possession from the time of collection, a chain of custody record must be filled out and accompany every sample. This record becomes especially important when the sample is to be introduced as evidence in court litigation. An example of a chain of custody record is illustrated.

The record must be contain the following minimum information:

Collector's sample number

Signature of collector

Date and time of collection

Place and address of collection

Waste type

Signatures of persons involved in chain of possession

Inclusive dates of possession

ANALYTIC & BIOLOGICAL LABORATORIES, INC.
24350 INDOPLEX CIRCLE, FARMINGTON HILLS, MI 48331
(313) 477-6666 FAX: (313) 477-4604

Collector's Sample No. _____

CHAIN OF CUSTODY RECORD

Location of Sampling: _____

Sample Identification: _____

Shipper Name: _____

Shipper Address: _____
street city state zip

Collector's Name: _____ Telephone: _____

Date Sampled: _____ Time Sampled: _____

Type of Process Producing Waste _____

Field Information:

_____

_____

_____

Sample Receiver:

1. _____
Name and address of organization receiving sample

2. _____

3. _____

Chain of Possession:

1. _____
signature title inclusive dates

2. _____
signature title inclusive dates

3. _____
signature title inclusive dates

DATE 03-30-89

PRECISION AND ACCURACY CONTROL DATA

#	PARAMETER	RT TIME	SPIKE VALUE	RECOVERED VALUE	% RECOV
1	Methanol	1.71	10,000	10,910	109.1
2	Methylene Chlo	5.85	10,000	10,320	103.2
3	Acetone	7.66	2,000	2,088	104.4
4	Trichloro Fluo	8.20	2,000	2,108	105.4
5	Ethyl Ether	9.90	2,000	2,064	103.2
6	Carbon Tetrach	11.78	2,000	2,018	100.9
7	Ethyl Acetate	12.86	2,000	2,014	100.7
8	Butyl Alcohol	13.70	2,000	2,082	104.1
9	Pyridine	15.64	2,000	1,992	99.6
10	Trichloroethyl	16.44	2,000	2,090	104.5
11	Cyclohexanone	20.90	2,000	2,194	109.7
12	Methyl Isobuty	21.03	2,000	2,194	109.7
13	Tetrachloroeth	22.91	2,000	2,244	112.2
14	Toluene	24.06	2,000	2,034	101.7
15	Chlorobenzene	25.40	2,000	1,072	103.6
16	Ethyl Benzene	28.01	2,000	1,970	98.5
17	Xylene	33.65	2,000	2,102	105.1

SAMPLE ID : _____

COMPANY: _____

LAB ID #: _____

DATE 03-30-89

PRECISION AND ACCURACY CONTROL DATA

PARAMETER	SPIKE VALUE	RECOVERED VALUE	% RECOVERY
Arsenic	20.0	19.69	98.1
Barium	10.0	9.912	99.1
Cadmium	10.0	10.17	101.8
Copper	10.0	9.634	96.34
Chromium	10.0	10.43	104.3
Lead	10.0	10.23	102.3
Mercury	20.0	19.82	99.1
Selenium	20.00	19.88	99.4
Silver	10.0	20.37	101.9
Zinc	10.0	10.0	101.9

SAMPLE ID: _____

COMPANY: _____

LAB ID #: _____

PRECISION & ACCURACY

CONTROL DATA

PARAMETER: Copper

UNITS: mg/l

SPIKE: 10 mg/l

DATE	LAB I.D.	DUP. 1	DUP. 2	RANGE	AVG.	SPIKE VALUE	DIFF.	% REC
5-5	29459	.343	.346	.003	.345	10.99	10.645	106.4
5-10	24653	.105	.118	.013	.112	9.876	9.764	97.64
5-15	27858	.064	.059	.005	.062	10.38	10.318	103.2
5-17	26322	.046	.083	.008	.042	10.17	10.128	101.3
5-23	28569	.181	.189	.008	.185	10.49	10.305	103.0
5-24	28560	.187	.178	.009	.183	10.38	10.197	101.2
5-30	29468	.013	.009	.004	.011	9.71	9.699	96.99
5-31	29581	.035	.036	.001	.036	10.23	10.194	101.9
6-5	29763	.081	.088	.007	.085	10.24	10.155	101.5
6-7	29799	<.005	<.005	0	<.005	9.63	9.63	96.30
6-13	29805	.028	.031	.003	.030	9.61	9.58	95.80
6-15	29837	.033	.037	.004	.035	10.93	9.895	98.95

PRECISION & ACCURACY

CONTROL DATA

PARAMETER: Alkalinity

UNITS: mg/l

SPIKE: 200 mg/l

DATE	LAB I.D.	DUP. 1	DUP. 2	RANGE	AVG.	SPIKE VALUE	DIFF.	% REC
6-1	29459	59	61	2	60	262	202	101
6-4	24653	19	21	2	20	224	204	102
6-5	27858	57	61	4	59	260	201	100.5
6-7	26322	40	44	4	42	245	203	101.5
6-8	28569	16	24	8	20	220	200	100
6-12	28560	60	60	0	60	258	198	99
6-13	29468	49	51	2	50	250	200	100
6-14	29581	60	64	4	62	264	202	101
6-15	29763	39	41	2	40	240	200	100
6-26	29799	43	41	2	42	243	203	101.5

MONTH June

YEAR 1989

CHEMICAL PARAMETER: Arsenic

UNITS: mg/l

STANDARD VALUE: 100 mg/l

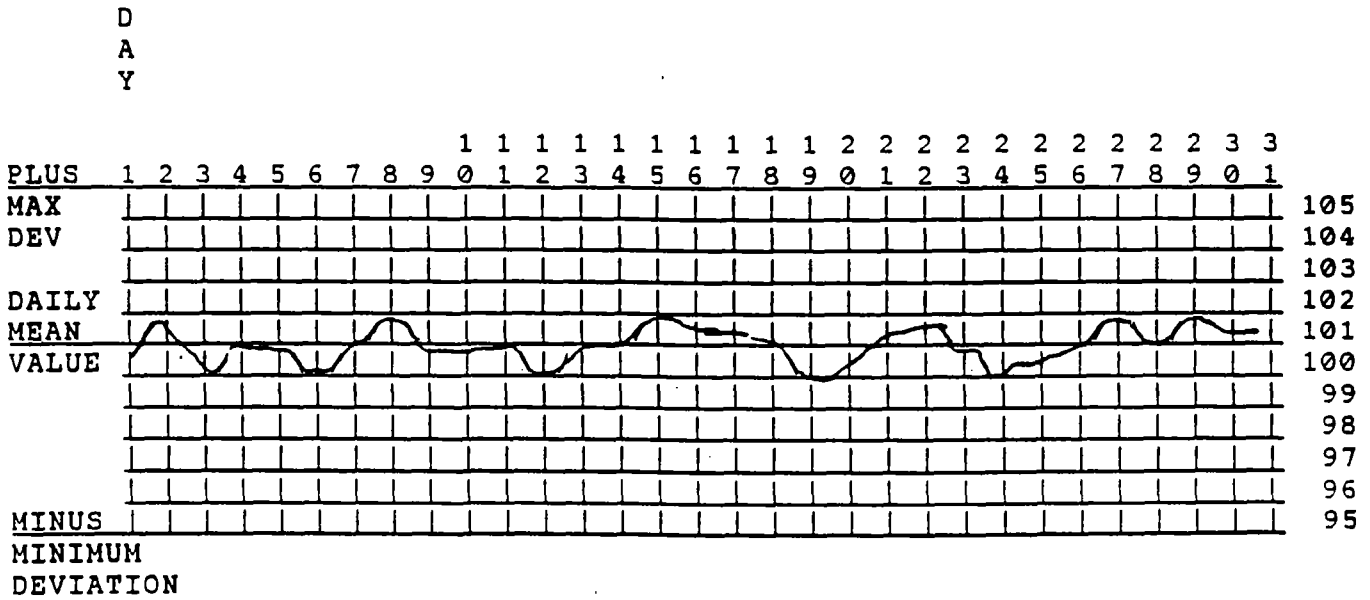


FIGURE 1

PRECISION CONTROL CHART

SAMPLE NUMBER VERSUS RANGE

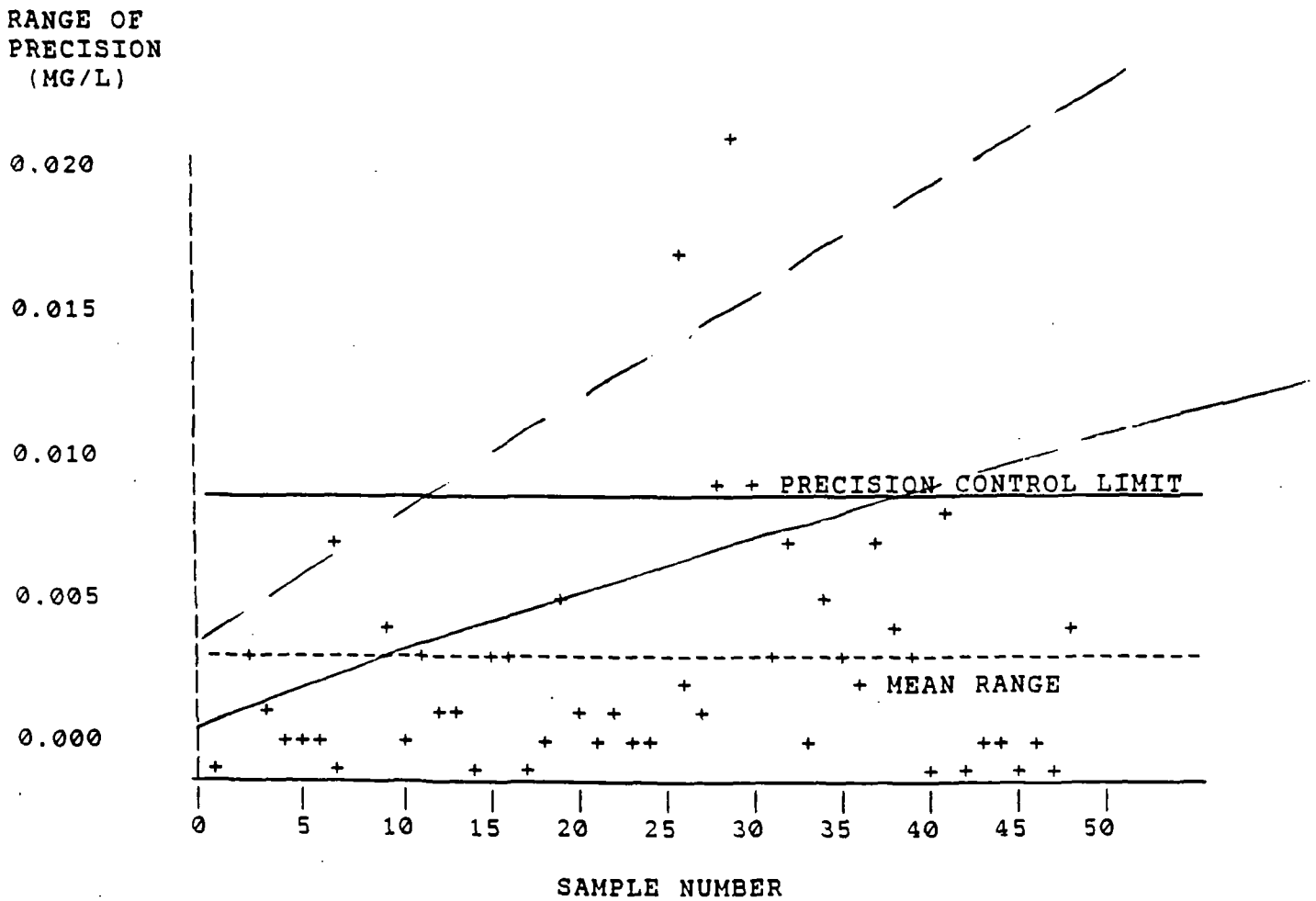


FIGURE 2

PRECISION CONTROL CHART

MEAN SAMPLE VALUE VERSUS RANGE

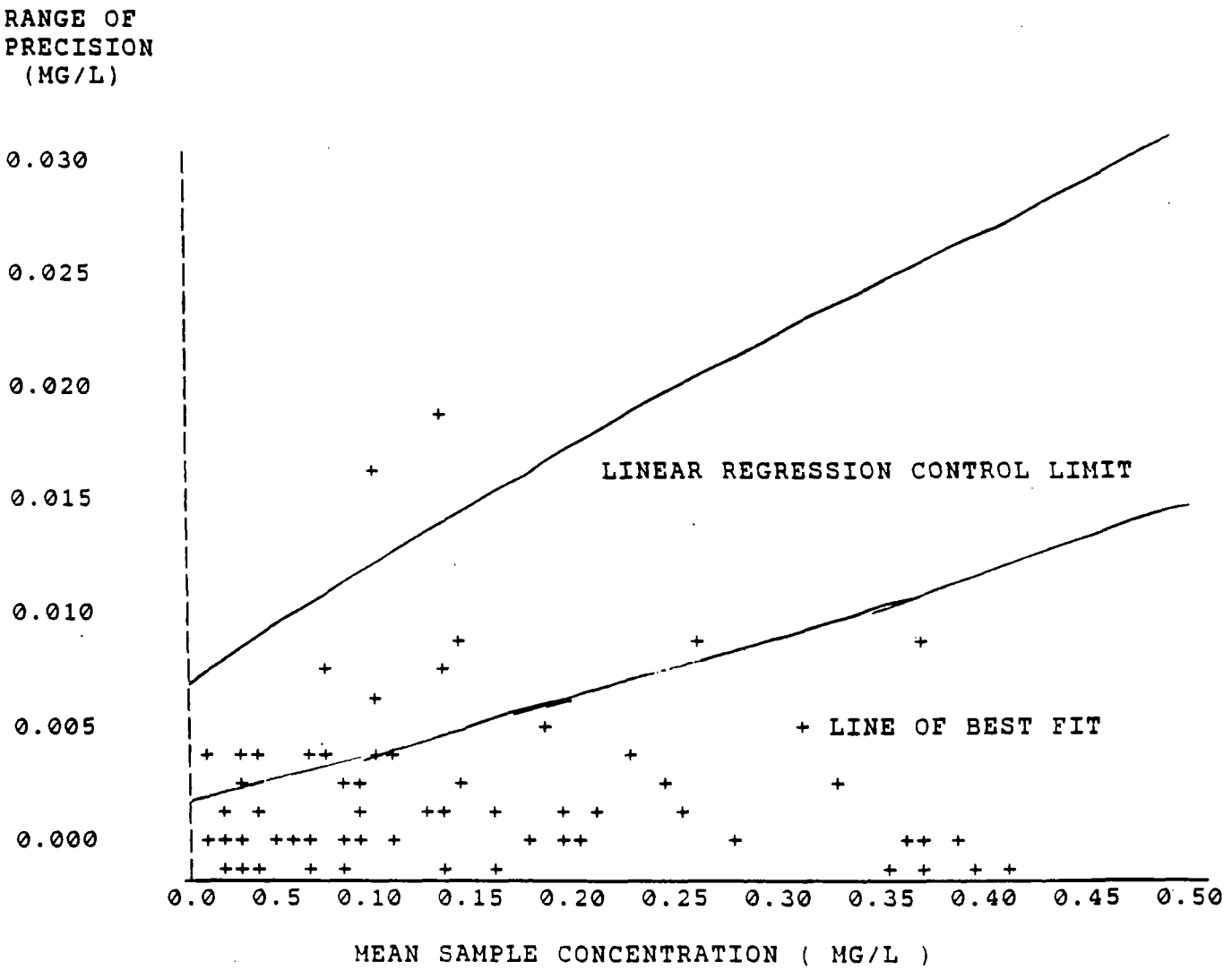


FIGURE 3

PRECISION CONTROL CHART

MEAN SAMPLE VALUE VERSUS RANGE

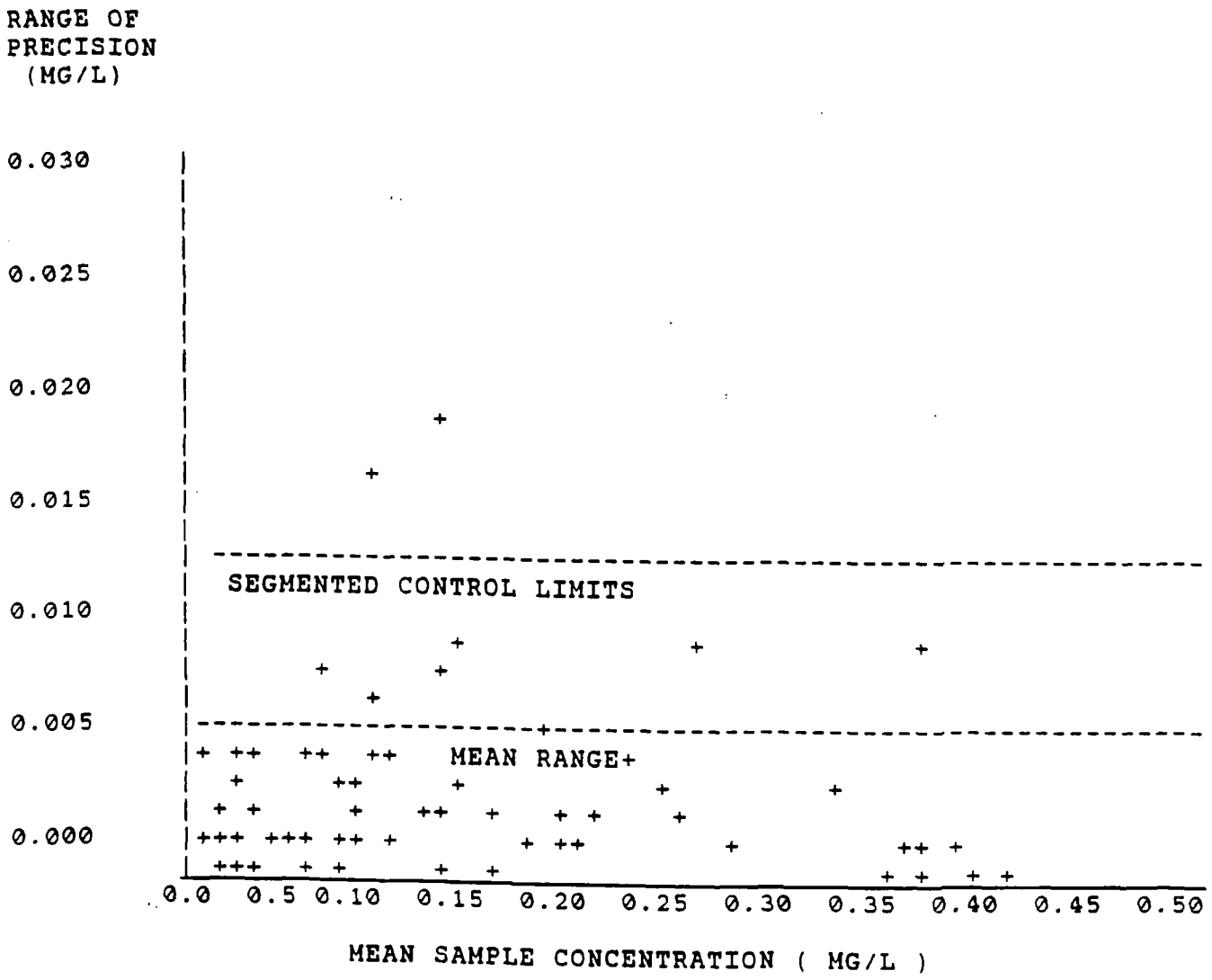
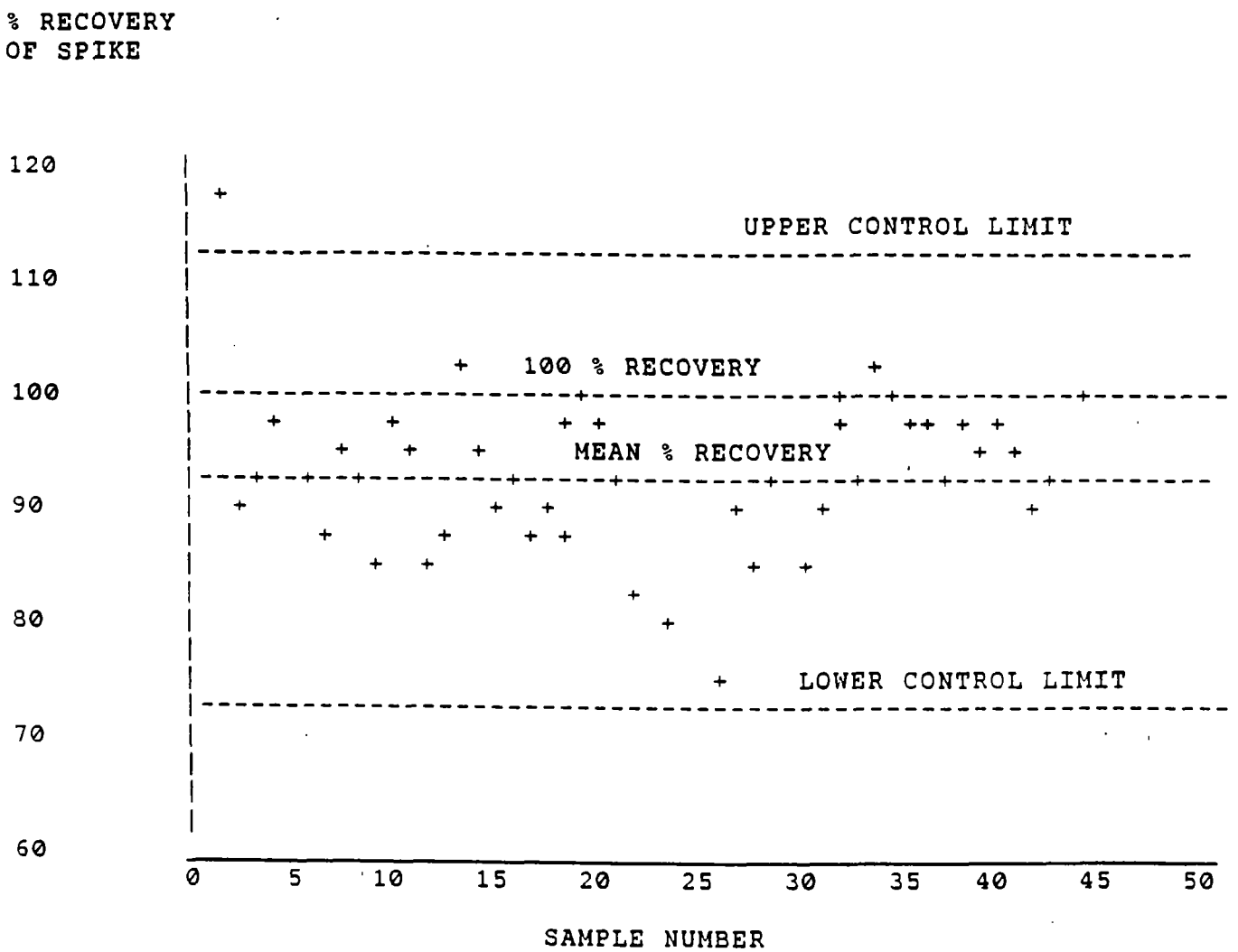


FIGURE 4

ACCURACY CONTROL CHART

SAMPLE NUMBER VERSUS % RECOVERY



APPENDIX G

LAB QA/QC DOCUMENTATION

QUALITY ASSURANCE / QUALITY CONTROL

MANUAL

CONTENTS

SECTION I

LABORATORY QUALITY CONTROL/QUALITY ASSURANCE PROGRAM

INTRODUCTION

Laboratory quality assurance is often considered the most important part of an organized quality assurance program. It is actually only one of the essential components. The often asked question, "how good is this particular value?", should often be answered with "how good was the sample as delivered to the laboratory?". If the sample is not representative of the original site; has not been collected in a suitable container; has not been preserved using the required technique and cannot be analyzed within the recommended maximum holding time, any effort the laboratory makes to document its accuracy or precision is generally of minimal value. Quality assurance must begin in the minimal value. Quality assurance must begin in the program planning stage and be carried through to how the final data is interpreted and utilized.

QUALITY CONTROL VS. QUALITY ASSURANCE

The terms quality control and quality assurance are quite often misunderstood and incorrectly used interchangeably. Laboratory quality control consists of those internal operations which are performed during the measurement process to document data quality (eg. split samples, spiked samples, reagent blanks, instrument calibration checks, etc.). Laboratory quality assurance consists of those activities performed with less frequency to obtain independent assessments of operating conditions (eg. independent reference samples, interlaboratory comparison studies, laboratory evaluation samples, etc.).

Documentation of Methodology

Before the results which are reported by the laboratory can be of any value, the analytical methods used must be appropriate for the particular sample type, be capable of performing with the necessary sensitivity and produce data which is free of bias. Environmental Laboratory Procedure No. PD-14: "Methodology Approval" addresses the correct procedure for evaluating whether a method is capable of performing adequately. There are many standard laboratory references (eg. Standard Methods for Examination of Water and Wastewater, 1975, APHA-AWWA-WPCF; "Methods for Chemical Analysis of Water and Wastes, US EPA, March 1979, EPA-600-/4-79-020; Annual Book of ASTM Standards, Part 31; etc.) which have documented most of the more common environmental laboratory procedures.

The current Federal Register "List of Approved Test Procedures" should be consulted before initiating use of particular methodology. This list, compiled by the U.S. Environmental Protection Agency for Analysis of NPDES compliance monitoring samples, references the methods deemed most appropriate for analysis of environmental water samples. Whenever practical, an "EPA approved" method should be employed. If a "better" method (eg. more accurate, improved efficiency, greater sensitivity, better precision, lower operating cost, etc.) is available, it has to be compared to an approved method to demonstrate equivalency. The EPA Regional Administrator must also approve its applicability for use on certain Federally-funded programs, especially NPDES compliance monitoring. Formal application following an established protocol should be followed for alternate test procedure approval.

Although most methods in use in the laboratory closely parallel standard referenced procedures, the exact laboratory method in use should be well documented and a copy maintained at the bench for easy accessibility. Environmental Laboratory Procedure No. PD-15; "Methodology Write-Up Format" explains a proper manner of writing laboratory methods. A standardized format improves readability of laboratory methods. Any deviations from standard references should be carefully noted and any interferences encountered during routine laboratory testing explicatively described.

ANALYST CERTIFICATION

Once a method has been proven to be suitable for certain samples, the analyst performing the analysis must demonstrate proficiency with the particular analytical technique. Environmental Laboratory Procedure No. PD-16 "Analyst Certification" details the necessary steps. During the "Methodology Approval" procedure, the expected performance of a method is established. The performance of the analyst should be checked against past standards and any significant variations investigated. Only after analysts have proven capable of generating valid data should their results be reported.

LABORATORY QUALITY CONTROL CHECKS

The Measurement of Precision

Quite often a data user will inquire as to the precision of a particular method or parameter. Depending on the parameter this may be fairly easy or quite difficult to establish and the precision of any individual value would be very sample dependent. Because precision is an estimate of procedural variability, it is often derived from the measurement of duplicate aliquots of samples or standards. Precision is usually expressed as a standard deviation and can be calculated by any of the following procedures.

1. Precision as determined by Between-Run Duplicates.

Between-run duplicates are two separate aliquots from one sample which are analyzed separately in two analytical batches. This approach cannot be used with labile parameters but works best when there is sufficient volume of sample and the constituents of interest are conservative. The reliability in your estimate of the population standard deviation increases with increased population size. Forty to fifty pairs of data are desirable for an initial estimate, although fewer pairs may be used if that's all the value that are available.

Table 1 consists of 48 sets of data which can be statistically analyzed for the purpose of setting quality control limits. For each sample, consider the first values and the second values as having been analyzed in two separate runs or batches of samples. The range is the absolute difference between the two values. When there is no measurable difference in a pair (Samples 1, 8, 14, 17, 42, 45 and 47), the recorded difference is reported as one half of the minimum sensitivity of the analytical system. This is necessary because some analytical systems are fairly insensitive and little or no difference may be measured in paired samples when calculating control limits, which results in artificially low limits. Any measured difference on a sample pair may then indicate an out-of-control situation.

Each set of data could be evaluated using more than one method. Any gross outliers should be immediately rejected and not included in further evaluation. Questionable data should be included initially and be rejected after preliminary evaluation. First, the mean range is calculated:

$$\bar{R} = \frac{\geq R}{n} = \frac{0.1515}{48} = 0.00316$$

where R = mean range

R = individual range values

n = number of values in group

The standard deviation, s, can be estimated by dividing the mean rage, R, by 1.13 and obtaining 0.00279 mg/l. It is generally customary to use "3 σ" limits for most control charts. This is equivalent to a Type 1 error 0.003, meaning that there would be three chances in 1,000 of calling the system out-of-control when it is not. The precision control limit for this method 0.0084 mg/l. Any time a range value for precision is higher than this, the test would be shutdown, any problems located and corrected and all suspect run of samples repeated. This limit suggests the system was out-of-control for samples 25, 28, 29 and 30.

With most analytical methods, the standard deviation increases as concentration of the analyte increases. This was not taken into account in our previous example. One method of checking for this is a linear regression analysis of the mean concentrations of the paired values versus the range of the difference of the paired values. A statistical analysis of the values in Table 1, excluding sample 25 and 29 because of their high range values, results in a line with a slope of 2.00 %, y-intercept of 0.00126 mg/l and a correlation coefficient of 0.597. 3 σ control limits as calculated from this method would range from 0.0034 mg/l at the lower end of the analytical working range to 0.0297 mg/l at the upper end (0.500 mg/l). This method of analysis indicates that samples 7, 25, and 29 were out-of-control in relation to desired precision.

The linear regression approach to precision analysis is quite often not a valid approach. If a statistical analysis results in correlation coefficient lower than 0.050, it should be probably not be applied to further use. One exception would be if the precision of a test actually improved higher concentration. Then a correlation coefficient less than 0.050 may be acceptable. Correlation coefficients between <0.50 and 0.50 would indicate a general liability to estimate an acceptable precision based on the concentration of samples. Another serious problem with this particular approach is that the line which is derived is based on the data which is available and if the whole analytical working range of a method is not well defined, the line may not be applicable for the whole range. This is sometimes noted by a negative y-intercept.

Still another approach which can be used to allow for increased imprecision over the analytical working range of a test is to segment the results into narrower bands. If the sample values in the Table 1 are dichotomized such that the values below 0.050 mg/l and those above are analyzed separately, there are 26 sets of values in lower group and 22 sets in the higher group. The mean range for the lower group is 0.0018 mg/l, which is equivalent to a standard deviation of 0.0016 mg/l and three precision control limits of 0.0048 mg/l. For the higher group, the mean range is 0.0046 mg/l, the standard deviation is 0.0041 mg/l and the 3σ control limit is 0.0122 mg/l. From this method of analysis, samples 7, 25, and 29 are again out-of-control relative to precision. This approach is valid when sufficient segments are used adequately to decide when a system is truly in a state of control. The above example should have a third intermediate segment so that the break at 0.0050 mg/l is not so great (0.0048 mg/l below versus 0.0122 mg/l above).

Although each of the three above examples are significantly different in their approach to precision control, they all agree that the samples 25 and 29 were out-of-control. Additionally samples 7, 28 and 30 were also deemed out-of-control by at least one of the three methods. The method of choice depends on the particular analytical method of interest and individual preference. Some methods may require an entirely different approach to the control of precision.

2. Precision as determined by Within-Run Duplicates.

With non-conservative parameters, between-run duplicates may be impractical and within-run duplicates would give a better estimate of precision control. This could be seen on between run duplicates if the second value was routinely lower (or higher) than the first value due to chemical degradation and should be expected with parameters having short holding times. The interpretation of data would be the same as in the previous example, but the two sample values and spike value for each sample in Table 1 would be interpretated as having been analyzed in a single analytical batch. The major disadvantage of this approach is that systematic errors (usually calibration problems) would be much less noticeable.

Use of Precision Control Charts.

Quality control charts are often used to evaluate daily performance. Dr. Walter A. Shewhart of Bell Telephone Laboratories is credited with the development of the basic theory of control charts, for which reason they are often called Shewhart quality control charts. Their main value is a graphic representation of the state of control at a given time compared to the past trends and established limits. The industrial approach has been modified over the years to accommodate use in environmental laboratory situations.

Figure 1 shows the precision control chart for the values in Table 1 when the ranges of the duplicate values are plotted against sample number. Generally the x-axis would have direct relationship with time, but the data in Table 1 was not collected in that manner. If the values are considered as having been plotted in chronological order, it could be stated that for the period of time from samples 25 through 30, the analytical system was out-of-control relative to expected precision. Any range value from duplicate sample which exceeds the established precision control (0.0094 mg/l for the example used in Figure 1) would result in an immediate investigation into the source of excessive deviation, a correction of the problem and an additional analysis of all suspect values. If unable to repeat questionable results due to insufficient sample volume or expiration of the maximum holding time, no laboratory result or a coded value should be reported by the laboratory unit supervisor. From Figure 1, excessively large precision control problems existed for samples 25 and 29. There were smaller problems for samples 28 and 30.

Figure 2 is a precision control chart from the data in Table 1 when the ranges of the duplicate values are plotted against the mean sample concentrations. The slanted dashed line is the line of best fit as defined by linear regression analysis. The solid slanted linear regression control limit is derived from multiplying the y-intercept and slope by 2.65 (equivalent to division by 1.13 conversion of mean range to standard and multiplication by three to establish three control limits). Sample 7 is slightly out-of-control and gross precision control problems exist for samples 25 and 29.

Figure 3 is a precision control chart from data in Table 2 with the ranges also plotted against the mean sample concentration. Mean sample concentrations below 0.050 and over 0.050 mg/l were analyzed separately and the corresponding 3 control limits were plotted for each segment. The same samples were out-of-control by this method as by the previous method.

The Measurement of Accuracy

The accuracy of any method is more difficult to define and the accuracy of an individual sample analysis may not be capable of definition. Attempts to measure accuracy are hindered by the imprecision of the analysis, possible incomplete recovery of digestion of extraction step and the presence of unknown interferences which could cause high or low biases. A method may be considered as accurate if none of the steps in the analytical procedure introduce a variable bias and there are no common interferences. A nonvariable bias, such as 90 % recovery in an extraction step, can be handled by proper calibration of standards. A variable recovery should be sufficiently documented so that data users can establish confidence intervals for results.

TABLE 1
EXAMPLE OF PRECISION AND ACCURACY DATA
Sample Values in mg/l

Sample Number	1st Value	2nd Value	Range	Spiked Value	Spike Recovered	% Recovery	% Bias
1	0.033	0.033	0.0005	0.152	0.119	119.	+19
2	0.020	0.023	0.003	0.113	0.0915	91.5	-8.5
3	0.038	0.036	0.002	0.129	0.092	92	-8
4	0.018	0.019	0.001	0.116	0.0975	97.5	-2.5
5	0.021	0.022	0.001	0.113	0.0915	91.5	-8.5
6	0.046	0.045	0.001	0.134	0.0885	88.5	-11.5
7	0.045	0.039	0.006	0.134	0.092	92.	-8
8	0.018	0.018	0.0005	0.109	0.091	91	-9
9	0.035	0.039	0.004	0.124	0.087	87	-13
10	0.013	0.014	0.001	0.111	0.0975	97.5	-2.5
11	0.003	0.006	0.003	0.101	0.095	96.5	-3.5
12	0.011	0.013	0.002	0.099	0.087	87	-13
13	0.045	0.043	0.002	0.133	0.089	89	-11
14	0.027	0.027	0.0005	0.128	0.101	101	+1
15	0.016	0.013	0.003	0.110	0.0955	95.5	-4.5
16	0.043	0.040	0.003	0.131	0.0895	89.5	-10.5
17	0.021	0.021	0.0005	0.114	0.093	93	-7
18	0.014	0.015	0.001	0.102	0.0875	87.5	-12.5
19	0.045	0.041	0.004	0.133	0.090	90	-10
20	0.018	0.016	0.002	0.106	0.089	89	-11
21	0.010	0.011	0.001	0.108	0.0975	97.5	-2.5
22	0.019	0.021	0.002	0.112	0.092	92	-8
23	0.006	0.005	0.001	0.098	0.0925	92.5	-7.5
24	0.008	0.007	0.001	0.101	0.0935	93.5	-6.5
25	0.075	0.059	0.016	0.154	0.087	87	-13
26	0.018	0.020	0.002	0.114	0.095	95	-5
27	0.023	0.022	0.001	0.118	0.0955	95.5	-4.5
28	0.192	0.183	0.009	0.272	0.0845	84.5	-15.5
29	0.093	0.112	0.019	0.183	0.0805	80.5	-19.5
30	0.316	0.307	0.009	0.386	0.0745	74.5	-25.5
31	0.168	0.171	0.003	0.258	0.0885	88.5	-11.5
32	0.284	0.278	0.006	0.365	0.084	84	-16
33	0.107	0.106	0.001	0.206	0.0995	99.5	-0.5
34	0.060	0.055	0.005	0.142	0.0845	84.5	-15.5
35	0.084	0.087	0.003	0.177	0.0915	91.5	-8.5
36	0.096	0.098	0.002	0.186	0.089	89	-11
37	0.085	0.079	0.006	0.177	0.095	95	-5
38	0.063	0.059	0.004	0.153	0.092	92	-8
39	0.087	0.090	0.003	0.190	0.1015	101.5	-1.5
40	0.061	0.060	0.001	0.160	0.0995	99.5	-.5
41	0.097	0.090	0.007	0.190	0.0965	96.5	-3.5
42	0.053	0.053	0.0005	0.149	0.096	96	-4
43	0.097	0.096	0.001	0.190	0.0935	93.5	-6.5
44	0.131	0.130	0.001	0.226	0.0955	95.5	-4.5
45	0.081	0.081	0.0005	0.176	0.095	95	-5
46	0.112	0.113	0.001	0.203	0.0905	90.5	-9.5
47	0.080	0.080	0.0005	0.173	0.093	93	-7
48	0.069	0.065	0.004	0.167	0.100	100	0

One of the most common methods of measuring accuracy is through spike recovery, where another measured aliquot of sample is taken spiked with a known amount of analyte, analyzed in the same manner, then the recovery of spike is calculated as follows:

$$\% \text{ RECOVERY} = \frac{\text{SPIKE SAMPLE CONCENTRATION} - \text{UNSPIKED RESULTS}}{\text{THEORETICAL SPIKE}} (100)$$

So, if a sample containing 0.053 mg/l of analyte is spiked so that an additional 0.100 mg/l should be found and a value of 0.149 mg/l is obtained, the % recovery would be 96 %.

$$\% \text{ RECOVERY} = \frac{0.149 - 0.053}{0.100} (100) = \frac{.096}{.100} (100\ \%) = 96\%$$

If % bias is preferred, subtract 100 % from your % recovery value.

$$\% \text{ BIAS} = \% \text{ RECOVERY} - 100\ \%$$
$$= 96\% - 100\ \% - 4\%$$

Our previous example indicated a 4 % low bias.

In Table 1, the data in the "Spiked Value" column was obtained by analysis of an aliquot which had been spiked to an additional concentration of 0.100 mg/l. The amount of spike and a % bias are calculated for each sample using the mean of the first and second value for each sample. The standard deviation of the spiking recovery procedure is found to 0.0066 mg/l. The mean of the differences from the expected spike is -0.0075 mg/l (% bias of -7.5%).

The absolute value of the mean (0.0075 mg/l) is greater than the standard error of the mean of the spiking recovery procedure (0.0065/48 = 0.00094 mg/l), which indicates that the spiking recovery procedure is biased. A low recovery (92.5%) would be expected as normal. Control limits set from this data would be for 0.0925 +/- 3 x 0.0065. or from 0.073 to 0.112 mg/l as an acceptable recovery on the spike. The only out-of-control sample was number 1 which had a higher than acceptable recovery (119%).

Figure 4 is an accuracy control chart for the data in Table 1. In addition to halting analyses when an out-of-control situation exists, any trends should be noted and evaluated before serious problems arise.

The routine low bias in the above example indicates a problem with the analytical procedure, the method of measuring accuracy, or a combination of the two. If the problem is with the method of analysis, the step causing low bias should be located and changed. Some analytical procedures may allow for a recovery correction factor. If the problem is due to the method of evaluating the accuracy of the method, necessary changes should be made so that a valid audit is obtained. Possible sources of poor spike performance are a bad spiking standard (which should be prepared independently of calibration standards), improperly calibrated micro-pipets, improper use of micro-pipets, large spiking volume causing volume correction problems, too small spiking volumes causing excessive spike deviation and sample matrix interferences.

The measurement of accuracy through spike recovery is not applicable for many parameters (pH, specific conductance, dissolved oxygen, suspended solids, biochemical oxygen demand, bacteriological determinations, etc.) and are impractical for some sample matrices (tissue, sediment, oils, etc.). For these samples, other forms of accuracy control should be investigated and utilized.

Other common methods of evaluating operating accuracy is the use of a stable standard, a standardized natural sample for which an expected value has been determined or a standard reference material (available from the National Bureau of Standards, etc.). The accuracy data from these three examples would be interpretated similarly. Consider the values in Table 2 as either having been collected from a single analysis of either a stable standard, stabilized natural sample or standard reference material in fifty separate analytical batches. The "true" value in 25.0 mg/l. The mean value of all the data is 24.97 mg/l with a standard deviation of 0.94 mg/l. Using 3 standard deviation control limits, the system is in control for standard values from 22.2 mg/l to 27.8 mg/l, indicating an out-of-control situation for samples 22 and 26. When these values are excluded, the new mean and standard deviation are 25.00 and 0.53 mg/l respectively. The proper control limits would be from 23.4 to 26.6 mg/l. A standard value outside this range would suggest that a problem with the accuracy of that set existed and that the batch should be repeated after the appropriate corrective measures have been taken.

TABLE 2

TABLE 2
EXAMPLE OF ACCURACY DATA
Standard Value in mg/l

Sample Number	Standard Value	Sample Number	Standard Value
1	25.1	26	28.3
2	24.7	27	25.5
3	24.3	28	24.8
4	25.0	29	24.2
5	25.6	30	24.9
6	25.5	31	25.7
7	25.2	32	25.3
8	24.6	33	25.2
9	24.4	34	24.2
10	25.2	35	25.1
11	25.9	36	25.0
12	25.1	37	25.9
13	25.2	38	24.7
14	24.3	39	25.0
15	24.9	40	24.9
16	24.4	41	24.1
17	25.5	42	24.7
18	24.3	43	24.9
19	25.6	44	25.7
20	25.9	45	25.5
21	24.1	46	25.2
22	20.6	47	25.0
23	24.9	48	24.7
24	25.2	49	24.1
25	26.0	50	24.6

Equipment Logbook

To insure that all laboratory equipment and apparatuses are operating properly and are routinely maintained, equipment logbooks should be maintained by the analysts. Each analyst and unit supervisor should decide what equipment should be checked, what variable should be monitored, the frequency and type of monitoring and establish a routine maintenance schedule as necessary, "Quality Assurance Practice and Procedures", U.S. EPA, Region V should be consulted as a guideline.

Reference Sample Evaluation

Reference samples should be prepared, analyzed and evaluated periodically (usually quarterly) as an independent audit of laboratory performance. The U.S Environmental Protection Agency distributes sets of many parameters upon request and other sets are commercially available (Environmental Resource Associates, etc.). They are of a primary value as an outside check on calibration standards and are useful in evaluating new methods. Although "true" values are supplied with reference samples, analysts should analyze reference samples without previous knowledge as to the expected values unless some idea of the expected range is necessary to establish the best method of analysis or proper dilution. If more than one method of analysis is routinely employed or more than one analyst commonly performs certain analyses, each method and analyst should be evaluated separately. The values reported by the analysts should be compared to the "true" values and the bias and % bias calculated for each result. Besides evaluating each sample statistically, careful attention should be paid to any trends. A five percent low result on one sample may be acceptable, but five percent low results on all samples for a parameter may indicate a correctable low bias.

Interlaboratory Comparisons and Evaluations

As an additional check on laboratory performance, all interlaboratory comparisons and evaluations should be participated in if the parameters and matrices under study are routine laboratory analyses. The International Joint Commission periodically conducts interlaboratory comparisons covering a variety of parameters in different matrices. The U.S. Environmental Protection Agency annually conducts laboratory evaluation studies. When the results are evaluated and returned (which may take several months), the conclusions of the studies should be confirmed and any necessary corrective measures taken. Values for non-routine laboratory parameters should not be reported for evaluation because they do not reflect laboratory performance and may create incorrect impressions as to the quality of results reported by the laboratory.

Calibration

Instrument calibrations should be established or confirmed with each batch of analyses or more often as necessary. If analytically practical, methods with linear responses should be calibrated with a baseline control or blank (0 % full scale), a mid-scale standard (40 - 60 % f.s.) for calibration, and high standard (80 - 100 % f.s.) to verify linearity and slope calibration and a low standard (5 - 20 % f.s.) to verify the blank or baseline. Parameters which conform to Beer's law should only be evaluated using a linear regression (first order polynomial) fit. Using a higher order fit would result in masking bad calibration points and improper calibration. A minimum of four points is desirable so that a bad calibration standard should be determined and rejected. Most "good" linear methods will result in a correlation coefficient of 0.98 or higher. A lower correlation coefficient would suggest an erratic test, a bad calibration standard or a non-linear response. Three control limits should be applied to the appropriate calibration checks as determined by the unit supervisor and analyst.

Non-linear methods require additional calibration points to define the working curve. Five to seven or more calibration points should be used depending upon the complexity of the analytical curve. A simple parabola can be defined by a non-linear regression analysis using a second order polynomial fit. Use of five calibration points will allow identifications and rejection of a bad point. More complex curves will require other approaches to calibration curves and should be handled on a case by case basis.

FIELD SAMPLING QUALITY CONTROL

Introduction

To obtain a valid quality control assessment, certain steps must be taken by field sampling personnel. These should definitely include field replicates and blanks, and may additionally include split samples, field spikes into samples and field spikes into laboratory distilled water. The results from these field audits may be independtly evaluated by proper trained personnel for maximum effectiveness.

Field Replicates

Field replicates are simultaneous independent samples taken from one sampling point. Depending on the parameters, these may be side-by-side grab samples or composite samples mounted in parallel. Samples should be identified as replicates when submitted to the laboratory for maximum utilization of them. The main purpose of a field replicate is to provide additional sample for laboratory quality control and check on the variability of the sample. Many organic parameters require that all of the sample be used for a single analyses. Also, the quality control data generated by the laboratory from a single sample container may not be indicative of the true variability of the sample concentration, but only of the variability introduced by the laboratory, which may be a small portion of the variability. All programs should have about four percent (one out of twenty-five samples) replication.

The advantages of notifying the laboratory as to the duplicate nature of samples over "blind" replicates lies in their potential maximum use if properly reviewed. The variability found in field duplicates should be checked against the expected variability of laboratory precision. Significant differences should be investigated as thoroughly as possible. If sufficient sample volume remains, the sample can be repeated to verify laboratory values. Causes for excessive variability not due to laboratory precision should try to be located and corrected and if unable to remedy, properly documented as to the extent of variability. "Blind" replicates are seldom used for more than an informal audit of laboratory performance.

Field Blanks

Field blanks are very important as a check on the cleanliness of sample containers, the purity of any chemical preservatives and possible contamination due to improper sample handling. Sample bottles containing laboratory prepared water (deionized - distilled or whatever is deemed more appropriate) should be picked-up at the laboratory with sample bottles for surveys or projects. Field blank bottles should be required with other sample bottles using a "Sample Bottle and Preservation Request" form.

Field blanks are not practical for all parameters and should not be attempted for the following sample containers: sediment, sludge, soil, tissue or matrices other than water, dissolved oxygen or flash point determinations. Field blanks are of maximum value when a chemical preservative is added which could be contaminated with the parameters to analyzed. Ideally, each batch of samples collected should have appropriate field blanks, especially where litigation is imminent. The preservative should be added to the sample in the field at the time other samples are set.

Proper interpretation of the values obtained from field blank analysis is difficult. Acceptable limits should be established based on the variability of actual field blanks and analytical precisian of each parameter. When a field blank value is found to be excessive for a parameter, the results for that parameter should ideally be discarded and the source of the problem located if possible. Any chemical preservatives under suspicion should be immediately recalled to the lab and replaced with a new lot. The preservative should then be checked by the laboratory using proper analytical techniques to verify that the preservative was contaminated. Results from sample batches with marginally unacceptable field blanks may be of some value depending on the intended use of results and the concentrations found. If results are used, they should be appropriately coded. Occasionally it is valid to subtract field blank values for sample results, but this practice should not be standard policy. Because of the inherent variability of an analytical result, abusive use of one value should be avoided. Also, because of the extreme sensitivity of some analytical method and variable impurities present, even in deionized-distilled water, positive values may be due to the water supplied for the field blanks.

The laboratory has had instances where the highest value for a batch of samples was the field blank. Sample bottles which do not receive chemical preservatives are still valid checks as field blanks to check on sample bottle suitability and handling procedures. Because these should be less of a problem, once proper documentation of the lack of a problem is made, the frequency can be limited to periodic checks.

Split Samples

If samples are to be analyzed by two or more different laboratories as check of analytical performance, it is imperative that each laboratory is analyzing the same sample to start with. A representative subsample of a homogenized sample should be submitted to each lab. It should be absolutely clear to all participants what parameters are to be analyzed and how they are to be reported. If there are only two participants, the results should be checked for overlapping confidence intervals based on expected precision of the two laboratories. It may be difficult to locate the source of any significant differences identified. Some of the most frequent causes of error are the use of an improper method, the improper use of a correct method, an inadequate quality control program or a poorly trained laboratory staff.

When more than two laboratories perform split sample analysis, it may be easier to spot poorly performing laboratories. Quite often, individual performance is measured against a median value or "true" expected value if available. Definite outliers should erroneously influence the results through common use of biased methods. Different studies may be require different methods of evaluation depending on individual circumstances.

Field Spikes

Field spikes of standards into samples or laboratory supplied distilled water are of major interest for special studies rather than routine use because of special precautions which should be taken. They are of value in determining the suitability of a sample container for certain parameters, the accuracy of methods and the applicability of holding times.

SECTION II

SELECTION OF SAMPLE BOTTLES, PRESERVATIVES AND MAXIMUM HOLDING TIMES

The laboratory will supply any sample containers which are to be used for samples to be analyzed by the ANALYTIC & BIOLOGICAL LABORATORIES, INC. or must approve the use of alternate bottles for collection. A variety of recommended sample containers are available with specific bottles or bags being recommended for various parameters groups because of: 1) the material(s) the container is constructed of; 2) physical properties of the parameter(s) to be analyzed; 3) sample volumes required for analyses; 4) special preservation requirements; and 5) the special needs of the laboratory unit performing parameter analyses. If there is some questions as to which sample container is required, consult the appropriate laboratory unit supervisor.

The chemical and physical preservation techniques to be used are available from laboratory unit supervisors. Preservation techniques are in accordance with EPA recommended procedures with occasional deviations due to particular laboratory situations requiring alternate preservation techniques. The protocol for alternate preservation techniques approval has been previously established by EPA, Region V and should be followed as necessary.

The maximum holding times recommended by the laboratory are generally the same as or slightly shorter than the approved EPA holding times. The holding time is time from sample collection until the sample is brought into a more stable state during the analysis process. It is not sufficient to merely receive the sample at the laboratory within the maximum holding time. Field personnel must keep in mind that the laboratory must have ample time to analyze the sample. The laboratory has the right and obligation not to analyze any sample which in their opinion may not be indicative of field conditions due to excessive holding time. Samples which have marginally exceed maximum holding times may be analyzed and appropriately coded at the discretion of the appropriate unit supervisor.

SAMPLE PARAMETER GROUP CODES

The following codes are used as a convenient reference so that field personnel can readily identify which sample container is necessary for any individual parameter. The parameter group codes are as follows:

LAB UNIT	PARAMETERS	CODE
Environmental Quality	Dissolved Oxygen	DO
	COD, TOC, Phenols	C/T/P
	Cyanide, Thiocyanate	CN
	Sulfide	S
	COD, Nutrients, Anions	ION
Organic Contaminants	Acid Extractables or Base-Neutrals Extract.	OEXT
	Purgeable Organics	PO
	O.C. Misc	OCM
	Oil & Grease	O&G
	Sediment, Sludge, Soil	OSSS
	Hazardous Waste	OHW
	Tissue	OTIS
Physical	Bacti	BAC
	Chlorophyll	CA
	Physical (residue, etc.)	PHYS
	Flash Point	FP

These codes should also be used by field personnel to facilitate identification and sorting of sample containers during the laboratory reception process.

USE OF THE SAMPLE BOTTLE AND PRESERVATION REQUEST

To facilitate the ordering of sample containers and preservatives, a "Sample Bottle and Preservation Request" form should be used. They should be filled out and received by the laboratory at least one week prior to the planned pickup time. If there remains insufficient time for proper notification, bottle orders should be prepared and phoned in to the proper designees in the Physical and Biological Lab Unit with as much advance notice as possible. Where more than one size bottle is identified, the responsible lab units should be consulted, or the following guidelines may be of value:

1) C/T/P - A 250 ml plastic bottle is sufficient if only chemical oxygen demand and total organic carbon or only phenolics are requested; a 500 ml bottle may be necessary for all three parameters (Note: Chlorinated sample for phenolics should be dechlorinated with ferrous ammonium sulfate and preserved separately from COD and TOC sample).

2) CN - A 500 ml plastic bottle is required if free cyanide is to be determined. Otherwise, a 250 ml container will be sufficient.

3) M-TOT - A 500 ml plastic bottle should be sufficient unless a) low detection limits are required, b) As, Se and/or Hg are requested in addition to other trace metals or c) a large number of metals (more than a dozen) are requested from each sample, in which case, a liter of sample may be necessary.

4) M-DIS - Same as above example (M-TOT)

5) M-SSS or M-TIS - Generally, a specimen bag is more suitable for tissue samples and a 250 ml wide-mouth glass bottle for sediment, sludge or soil for metals. The same sample may presently be shared by the Environmental Quality Unit.

6) PHYS - The number of residue analyses per sample is the main factor in determining the required size for physical bottle. If only pH, specific conductance, color and/or turbidity are required, 250 ml should be sufficient. If routine residues (filterable, non-filterable or total) are requested, a 500 ml bottle will suffice. Additional residue analyses (particularly settable residue) may require 1000 ml of sample.

There may be additional sample containers required for non-routine analysis not listed. Check with the laboratory if in doubt. It is generally better to make sure that the laboratory has sufficient sample in the proper container than to risk not receiving the desired analyses.

The chemical preservatives and dechlorinating agents are available from the laboratory either as a kit or as individual preservatives. Field personnel which routinely collect samples will find it more convenient to have a kit assigned to them and restock chemicals as needed or at least every six months. Personnel which do not frequently collect samples may find it more convenient to request preservatives with each survey or batch of samples and return the preservatives when samples are submitted to the laboratory. A preservative kit which is not frequently used should be carefully stored to prevent contamination of the chemicals. Most of the chemicals are stable and not prone to significant decay. Setting chemical preservatives blanks is imperative when a kit has not been used recently. Old kits must be returned to the lab for restocking.

LABORATORY RECEIPT OF SAMPLES

In the instance that your company finds it necessary to request emergency testing and analysis and have special samples you need to deliver to us, ANALYTIC & BIOLOGICAL LABORATORIES, INC. is generally able to receive samples from 8:15 AM until 5:00 PM Monday through Friday (with the exception of holidays). The lab may be able to receive samples at other times with prior notification and clearance. The sample receive entrance is at the front of the building. After admittance, the field personnel should set up samples from left to right in the order they will be recorded on the sample sheets. Each sample should be maintained in columns and the rows should be lined up by the parameter groups. The sample receiver then enters the lab log number, project code, case center number, priority and their initials on the sample blanks. Laboratory sample numbers are recorded on each of the proper blanks, the type of sample, the parameters to be tested for, the date the sample was taken, the date the sample was received , the company name, address, phone number and the initials of the receiver. Appropriate laboratory sample numbers are then noted on the sample containers. Field personnel should assist in wiping off wet bottles so the labels adhere properly. A copy of the sample receipt form is given to the field personnel for immediate review and future reference. Future laboratory identification will be based mainly on the sample number tag.

Lab unit supervisors or their representatives are then notified of the samples' existence. They then confirm that there is adequate sample to perform the requested analysis and that the samples are numbered and labeled correctly. If there is not enough sample available to complete the testing and allow for remaining sample to repeat the test if necessary, then it should be brought to the attention of the field personnel immediately so that additional sample can be collected and submitted as soon as possible.

LABORATORY SAMPLE HANDLING

Except for shared samples, each laboratory unit is exclusively responsible for maintaining the integrity of the samples it receives. Physical preservation must be sustained until the analysis is completed. Work assignments should be made on the bases of priority assignments, holding time, any existing backlog, present analytical capability, batch size efficiency and other factors. If individual analysts are unable to complete assigned work within the time allotted, the appropriate unit supervisor or lead worker should decide the order of completion or reassign other analysts to assist.

Each analyst is responsible for recording all pertinent information related to analyses they are performing in a concise, permanent manner which could be easily interpreted by other analysts familiar with the techniques involved. Bound notebooks with numbered pages are recommended over loose sheet because : 1) results remain in a chronological sequence in a bound notebook, 2) loose sheets are more easily lost, 3) loose sheets may not be acceptable as court evidence because they could be changed, and 4) bound data files are easier to maintain for long-term storage. All permanent work should be recorded in ink. Any corrections or changes to values should be done by drawing a single line through the old value such that it could still be read and then writing the new value. An explanation to any changes should also be included if necessary to clarify results. When performing analyses, any non-routine behavior by samples should be noted and explained if possible. Potential interferences should be monitored and removed where possible. Unexplained problems should be brought to the attention of the appropriate lead worker or unit supervisor for recommendations as to further actions. Calculations should be brought to the attention of the appropriate lead worker or unit supervisor for recommendations as to further actions. Calculations should be performed with attention to the rules for significant figures and rounding of numbers. Complex calculations should be performed with the aid of a programmable calculator to minimize analysts errors. Each analyst should also review their final results as much as possible through the proper quality control audits,
comparison with related samples and check for correlation with related parameters. Any bench notebooks or sheets should be kept for three years or longer if litigation is pending.

The unit supervisor's review before reporting laboratory data should include any of the following applicable steps: 1) review of quality control audits for suspicious data, 2) check for proper correlation of related parameters (which may require review of results from another lab unit), 3) analysis for reasonable trends within batches of related samples, or 4) comparison with previous results from the same sampling location. Questionable results should be investigated as thoroughly as possible.

The data supplied by the analysts may require rounding to the proper significant, coding with remark codes or conversion to the proper reporting units.

It is generally desirable to report two or three significant figures wherever practical when reporting laboratory data. Only one significant figure will probably be achievable near the analytical detection limit of a parameter. The confidence level or reliability of a result is dependent upon the variability of the method at the concentration level of measurement. If the standard deviation for a value is known, the confidence interval can be estimated for a desired confident level by:

confident level = $\bar{X}$ +/- z - x

where z is the normal deviate. If a value of 16.5 is obtained with a standard deviation (➢) of 0.3, various confidence intervals would be calculated as:

Confidence Level	Normal Deviate (z)	Confidence Interval
.68	1.00	16.2 to 16.8
.80	1.28	16.1 to 16.9
.90	1.64	16.0 to 17.0
.95	1.96	15.9 to 17.1
.98	2.33	15.8 to 17.2
.99	2.57	15.7 to 17.3
.998	3.08	15.6 to 17.4

A 95 % confidence interval is often used, meaning that when a value of 16.5 is reported for a method with a standard deviation of 0.3, the data user can be 95 % confident that the values lies between 15.9 and 17.1. On the average, the values will be outside this interval one out of twenty times.

When sample handling or laboratory operating conditions are less than optimum, the unit supervisor must decide whether results should be sent at all or with remarks to qualify potentially reliable data. If data is known to be unreliable, or highly suspected as such, no value is reported. Because environmental samples are ordinarily grossly heterogeneous, a large number must be analyzed to obtain meaningful data. The number of individual samples that need to be analyzed will depend on the kind of information required by the plan model. If an average compositional value is required, a large number of randomly selected samples may need to be obtained, combined and blended to achieve a reasonably homogeneous composite of which subsamples may be analyzed. If composition profiles or the variability of the sample population is desired, many samples may need to be individually measured in replicate.

A statistical approach to sampling is possible when the standard deviation of the individual samples is known in advance or be reasonably estimated. An example, described by Walpole and Myers (8), uses the expression where N = number of samples, Z = constant

$$N = (Z - n/E)^2$$

(standard - normal) ➢ n = standard deviation of individuals, and E = tolerable error in estimate of mean for characteristic measured.

For illustration, assume that the samples to be measured are expected to have a mean concentration of approximately 0.1 ppm and that the tolerable error in the stated value of the mean is at the 95 % confidence level (Z = 1.96) does not exceed 20 % (0.02 ppm). A further assumption is made that the measurement error is small in comparison with the measured values and can be neglected in the calculation. With the above values, the number of samples required will be

$$N = (1.96 \times 0.05) / 02 = 24^2$$

One could either analyze 24 individual samples or combine them and analyze a homogenized composite. However, the composite would not give any information on the variability of the individual samples (valuable for checking the sampling strategy used) not prove that a sufficiently homogeneous sample had been produced. The latter would require the analysis of a sufficient number of subsamples (seven is suggested).

Unfortunately, environmental trace analysis is often done where the standard deviation of the individual samples is not known in advance and where the measurement error cannot be predicted nor can it be assumed to be negligible. In this case, the measured values can be used to calculate an overall standard deviation, σ_o, which is related to the standard deviation of measurement, σ_n, and the standard deviation of individuals, σ_m, by the expression

$$\sigma_o^2 = \sigma_m^2 + \sigma_n^2$$

An estimate of σ_m can be obtained by a pooling process, using the differences in the measured values of duplicate homogenized samples. Then the standard deviation of the individual samples, σ_n, can be calculate. Unless such calculations are based on large numbers of measurements (at least seven) the standard deviation(s) may be significantly underestimated. In this case, the appropriate value of the Student's t test should be used and t values should be substituted for Z in equation 1 and similar expressions.

Equation 1 may also be used to estimate the number of replicate measurements, n, required on a homogeneous sample to achieve a mean value within a given confidence interval, E. In this case, o represents the standard deviation of measurement. The following transposition of the equation may be used to calculate

$$E = Z - m/n^{1/2}$$

The confidence interval, $\bar{x} = E$, for the mean of n measurement. When the data needed to calculate the minimum number of samples (N) are not available at the time of sampling, empirical approaches may need to be followed. In this case, the N-N-N rule is recommended as a helpful guideline, this means that equal numbers (N) of field samples, field blanks and spiked blanks are to be analyzed along with the calibrating standards and controls. The rule was first used in U.S.D.A. pesticide residue studies as the 10-10-10 rule. This meant that a residue study required analysis of a minimum of 20 samples, 10 field blanks and 10 spiked field blanks. A 7-7-7 rule is currently used by the U.S. Environmental Protection Agency in the analysis of water and waste water samples. Field blanks (sometimes call control studies in agricultural investigations) of environmental samples that are believed to contain the analyte at levels below the limit of detection of the analytical method. In certain circumstances a simulated or synthetic field blank is the only alternative.

APPENDIX H

OSHA 1910.120 TRAINING

GREAT LAKES ENVIRONMENTAL SERVICES, INC.

Corporate Health and Safety Program
Employee Training Summary

Great Lakes Environmental Services, Inc. (GLES) has adopted a Health and Safety Policy which specifies the functions and responsibilities of both GLES and its employees in creating and maintaining a safe and healthy work from harmful, hazardous and/or toxic substances, as well as unsafe work practices. The issue of safe work practices has been addressed in a companion document, the GLES Company Safety Manual. This document outlines the GLES policies for personnel involved in hazardous environments.

The GLES Safety Program serves as the minimum safety standards under which GLES employees may work. In any joint operation where Company personnel are participating in a project with other groups such as governmental agencies, private industry, or consulting organizations, the personnel protection defined in the GLES program must be maintained or GLES personnel shall not participate. No provision in any agreement entered into between GLES and any client, joint venturer, subcontractor, or entity may abrogate this requirement.

All persons who are involved in the implementation of these safety policies including those performing health data gathering, monitoring or testing services, laboratories, and clinics shall comply with all the standards set forth in the plan. Finally, all employees of GLES must comply with all requirements of the Health and Safety Program. Individuals who fail to comply with this plan are subject to termination for cause at the discretion of management.

Great Lakes Environmental Services uses a combination of in-house expertise, outside trainers, on-the-job training and monthly safety meetings to promote safe and legal work practices. The following is a summary of the training provided at Great Lakes Environmental Services for our employees and selected subcontractors:

1. <u>"History an Services of Great Lakes Environmental Services, Inc."</u>

   This program familiarizes the new employee with the various groups (departments), their responsibilities, how they interrelate, and the customer services that Great Lakes Environmental Services offer.

2. "Introduction to Hazardous Waste"

This module presents a historical view of the past mismanagement of hazardous waste materials and provides an initial understanding of Great Lakes Environmental Services' role in the correct management of hazardous wastes from "cradle to grave."

3. "Basic Safety, Part I"

The "Basic Safety" presentation introduces the employee to the concept that accidents have cause and effect relationships (hazards) which, if controlled, will prevent an accident from occurring or at least diminish its effects. The program brings to the attention of the viewer the need to recognize that hazards are not just external, that is, job related, but also include our attitudes, our behavior, and the conditions we create on the job. This presentation makes use of video clips, computer-generated title graphics, and a viewer interactive worksheet.

4. "Basic Safety, Part II"

The second half of the "Basic Safety" presentation reviews the safety-related sections in the employee's Safety Manual. The main purpose for this video production is to familiarize the employee with the content of each section of the Safety Manual.

5. "RCRA: An Overview"

This is a completely computer-generated graphics program transferred to video which presents a general overview of the Resource Conservation and Recovery Act (RCRA) and the Hazard and Solid Waste Amendments (HSWA). The program covers in a cursory manner the rules,, regulations, and responsibilities which apply to the generators, transporters, and treatment, storage, and disposal facilities in the correct management of hazardous wastes from the cradle to grave.

6. "RCRA Module, Part I"

The first of a three-part series, this presentation covers in detail the Resource Conservation and Recovery Act and Hazard and Solid Waste Amendments. This first part starts with a historical perspective of the environmental and health-related problems associated with the improper disposal of hazardous waste. This leads to a historical overview of the steps that lead to the development of RCRA and the early struggles that the Environmental Protection Agency had with establishing

itself as the enforcement body over these environmental problems. The last part of this program covers in detail the criteria (Code of Federal Regulations Volume 40, Part 261) that a generator would use to determine if any of the waste it generates is hazardous.

7. "RCRA Module, Part II"

Part II introduces the rules and regulations (40 CFR, Part 262) with which a generator of hazardous waste must comply. The program introduces the current three classes of generators and their responsibilities under RCRA and the HSWA. Since the "large quantity" generator is the most closely regulated, the program focuses primarily on the rules and regulations which apply to this generator group.

8. "RCRA Module, Part III"

Part III presents the regulatory requirements in 40 CFR which apply to transporters and treatment, storage, and disposal facilities. Since these sessions apply only to RCRA and the HSWA, only those requirements found in 40 CFR which apply to transporters are discussed. The DOT requirements found in 49 CFR are alluded to but not discussed.

9. Personnel Protection

This course reviews EPA Levels A, B, C and D Protection ad is repeated frequently for employees going to specific projects. Great Lakes Environmental Services' subcontractors must also complete this training before working in any contaminated (hot) cleanup zone.

10. "Respiratory Protection"

This program, through the use of videos, stresses the reasons for using an air purifying respirator, how to correctly fit test the respirator before use, the reasons for matching the canister to the chemical contaminants, the minimum oxygen level allowed for using an air purifying respirator, and introduces the positive pressure demand SCBA.

11. "Confined Space Entry"

This video introduces the new employee to what constitutes a confined space, demonstrates the proper procedures to be used for confined space entry, and conveys the message that all confined space work performed by Great Lakes Environmental Services' employees must be done according to our permit entry program which is covered in this program and in the Safety Manual.

12. "PCB Safety and Procedures"

This is Great Lakes Environmental Services' in-house course dealing with PCB regulations, safety, handling and packaging procedures, and spill cleanup.

13. "Right to Know"

This presentation was created in compliance with the Michigan Right to Know Law which required all non-manufacturers in the state to comply by February 25, 1987 with the Michigan and Federal Hazard Communication Programs. Basically, the program informs the employees of the potential physical and health hazards of the chemicals that are found in the workplace and on the job site. This training program contains all the parts as outlined in 29 CFR, Part 1910.1200, including labeling requirements, information found on the labels, the location and use of MSDSs (material safety data sheets), the location of the Written Hazard Communication, and the health and physical hazard effects that chemicals have on an individual.

14. CPR (Cardiopulmonary Resuscitation)

This is a hands-on course taught on-site at Great Lakes Environmental Services by the American Red Cross. Employees are issued a CPR certification card upon successful course completion.

15. First Aid

This course is completed at the American Red Cross of Michigan. Employees are issued a Standard First Aid certification card upon successful course completion.

16. OSHA 40-Hour Hazardous Waste Site Training
(See attached course outline)

In compliance with the provisions of 29 CFR, Part 1910.120 established for the protection of hazardous waste workers, Great Lakes Environmental Services' program includes training and certification in the following areas:

A. Site Safety Plan

B. Safe work practices

C. Emergency response and self-rescue

D. Safe use of field equipment

E. Handling, storage, and transportation of hazardous materials

F. Employee rights and responsibilities

G. Use, care and limitations of personnel protective clothing and equipment

H. Safe sampling techniques

17. Site Safety Plans

As required by 29 CFR, Part 1910.120, personnel are trained on the importance of and contents of Site Safety Plans. For every project, Site Safety Meetings are held with all personnel and subcontractors, following the contents of the Site Safety Plan. A Site Safety Plan outline is attached as Appendix A.

Safety Meetings

Great Lakes Environments Services, Inc. conducts regular safety meetings at our Warren facility and in the field during specific projects. Subjects such as new safety equipment, new procedures, seasonal hazards, customer quality control responses, and/or specific areas of employee concern are reviewed during these meetings. Daily meetings are conducted by superisors to discuss work changes and safety concerns on individual projects.

Employee training and safety meetings attendance are well documented, and these records are available for inspection at our headquarters in Warren, Michigan.

EMPLOYEE TRAINING CHECKLIST

NAME:_____ DATE:_____TITLE:_____
please print

signature_____

The following **Employee Training Checklist** is Great Lakes Environmental Services verification document that the above named employee has received the training specified below. The individual who's name appears on this document has dated and initialized each section in the presence of the undersigned training coordinator to verify that he/she has completed, and understood that section.

signed_____
Trainer

PART 1: INTRODUCTION AND ORIENTATION (3.75)

* History and Services of Great Lakes Environmental Services. (Video)
  date_____ initials_____ Credit: 45 minutes

* Introduction to Hazardous Waste Module. (Video)
  date_____ initials_____ Credit: 2 hours
  quiz taken on_____ with_____ percent correct

* Introduction to "HazWoper"
  date_____ initials_____ Credit: 1 hour

PART 2: RIGHT TO KNOW TRAINING (Video) (3.0)

* Right to Know Law Module
  date_____ initials_____ Credit: 3 hours
  quiz taken on_____ with_____ percent correct

PART 3: BASIC SAFETY (3.5)

* Basic Safety Part 1. (Video)
  date_____ initials_____ Credit: 2 hours
  quiz taken on_____ with_____ percent correct

* Basic Safety Part 2: (Video)
  date_____ initials_____ Credit: 1.5 hours
  quiz taken on_____ with_____ percent correct

PART 9: MONITORING (1.0)

* Discussion and Demonstration of Field Monitoring used at GLES.
  date_____ initials_____ Credit: 1 hour
  quiz taken on_____ with_____ percent correct

PART 10: HAZARDOUS WASTE AND THE EQUIPMENT TECHNICIAN (2.5)

* Video Presentation
  date_____ initials_____ Credit: 2.5 hours
  quiz taken on_____ with_____ percent correct

PART 11: THE CASE AGAINST PCBs (3.0)

* Video Presentation
  date_____ initials_____ Credit: 3 hours
  quiz taken on_____ with_____ percent correct

PART 12: LEVELS OF PROTECTION (4.0)

* Review "Level A, B, C, D of Protection" Section in Safety Manual

* Chemically Protective Clothing. (Video)
  date_____ initials_____ Credit: 1 hour

* Review "Heat Stress" Section of Safety Manual
  date_____ initials_____
  quiz taken on_____ with_____ percent correct

* Level A and B Dress Exercise
  date_____ initials_____ Credit: 3 hours

PART 13: SITE SAFETY AND HEALTH PLANS (1.0)

* Review and Discuss content of the Site Safety Plan
  date_____ initials_____ Credit: 1 hour

PART 14: FIRST AID/CPR (8.0)

* American Red Cross Training
  date_____ initials_____ Credit: 8 hours
  quiz taken on_____ with_____ percent correct

PART 15: ON THE JOB TRAINING

* Document three (3) days full days of On the Job Training
  Use OJT forms provided.
  OJT completed _____ initials_____

APPENDIX I

HAZARD COMMUNICATION PROGRAM

GREAT LAKES ENVIRONMENTAL SERVICES, INC.

HAZARD COMMUNICATION PROGRAM

General

The following written hazard communication program (as required by Michigan Public Act 154) has been established for:

Great Lakes Environmental Services, Inc.
22077 Mound Road
Warren, MI 48091

The program is available in the office library for review by all employees.

I. Hazard Determination

a. Great Lakes Environmental Services will rely on Material Safety Data Sheets (MSDS's) from material suppliers to meet hazard determination results requirements.

II. Labeling

a. The Operations Department shift foreman will be responsible for seeing that all incoming containers of supplies ar properly labeled.

b. All incoming containers of supplies must be labeled for: Identity, hazard warning, and name and address of manufacturer

c. Portable containers into which hazardous chemicals are transferred from labeled containers do not have to be labeled only if they are for the immediate use of the employee who performs the transfer. Other portable containers (e.g. 5 gallon pails, etc.) of materials filled from labeled hazardous chemical containers for use by others must be labeled in the same manner as the original container.

d. Piping systems shall by tagged in each area of the shop for the following "hazardous chemicals" where required:

Compressed air
Natural gas

III. Material Safety Data Sheets (MSDS)

a. The Director of Purchasing will be responsible for compiling the master MSDS file. It will be kept int he Director of Purchasing's office.

b Copies of all MSDS's for all hazardous chemicals which operations, maintenance, and field staff may use or have potential to be exposed to will be kept in a binder in the operations office. These may be reviewed upon request.

c. Copies of all MSDS's for all hazardous chemicals which the technical staff may use for laboratory screening will be kept in a binder in the lab. These may be reviewed upon request.

d. The Director of Purchasing shall require MSDS's for all supplies covered as hazardous or potentially hazardous chemicals. A file of follow-up letters shall be maintained by the Director of Purchasing for all shipments received without an adequate MSDS either on file or accompanying the shipment.

e. The Director of Purchasing shall provide the appropriate departments with the new or revised MSDS's within 5 days of receipt. The Director of Purchasing shall update the MIOSHA "New or Revised MSDS" poster (located on the company notice board) within 5 days of receipt of a new or revised MSDS.

IV. Employee Information and Training

a. A technical Director shall provide training programs and training documentation as required by this standard.

b. Before starting work, each new employee will attend a new employee orientation class (including basic safety). Each new employee will be issued a Great Lakes Environmental Services Employee Safety Manual which has information on:

- Safety
- Accidents and first aid
- Exposure hazards
- Basic chemical hazards
- Physical hazards
- Heat stress
- Personal protective equipment
- Respiratory protection
- DOT/EPA labels and placards
- EPA levels of protection
- Confined spaces
- PCB's
- Personnel and equipment Decontamination
- Hygiene
- Right to know
- Manifesting regulated wastes
- Transportation spill contingency plan

c. Employees will be trained in how to obtain and interpret MSDS information, label interpretation, and the details of this hazard communication program as covered in the "Right To Know" section of the safety manual.

d. When a new hazard is introduced into a work area in the form of a new hazardous chemical supply the employees in the work area must be trained in how to safely work with the new hazard and notified of MSDS availability. In cases of a new supplier providing a replacement material for an existing hazardous chemical with the same hazard a notification of new MSDS availability coupled with proper labeling shall suffice.

V. Hazardous Non-Routine Tasks

a. Use of hazardous chemicals in situations such as confined space entry and hot work requires that special precautions be

followed. Great Lakes Environmental Services Confined Space Entry Permit Program must be followed as per company policy for each and every entry.

VI. Informing Contractors

a. The Director of Purchasing will notify any contractor employees with employees working at the Great Lakes Environmental Services facility of the existence of our Hazard Communication Program. Instruction on how contractor employees may obtain MSDS information on hazardous chemicals that they may be exposed to while performing work at Great Lakes Environmental Services shall be included the notification may be via written notification on the original purchase order, letter, and/or via contractor orientation on site prior to work performance.

b. Where Great Lakes Environmental Services is acting as the general contractor on a construction project (lagoon closure, major site remediation, etc.), the Project Manager shall maintain a binder with Material Safety Data Sheets for each hazardous chemical used at the project site. The MSDS binder shall be kept in the site trailer and shall be made available to interested employees and subcontractors upon request. The existence and location of the MSDS binder shall be covered in site safety briefings and site orientation to employees and subcontractors.

VIII. List of Hazardous Chemicals

The following is a list of Hazardous Chemicals used at Great Lakes Environmental Services. Further information on each hazardous chemical noted can be obtained by reviewing Material Safety Data Sheets (MSDS') in the designated areas as per section III and VI of this program i.e.

Operations Office - maintenance and field staff

Lab - Laboratory screening staff

Site trailer - All staff on field projects where Great Lakes Environmental Services is the general contractor.

Additions will be made to this list as new materials are added and/or new hazard information becomes available. Deletions from the list will also occur in the event that a hazardous chemical supply is exhausted and no longer used.

penetone® CORPORATION
A Subsidiary of West Chemical Products, Inc.

74 HUDSON AVENUE, TENAFLY, NJ 07670
EMERGENCY TEL. NO. (201) 567-3000

MATERIAL SAFETY DATA SHEET

(Confidential Formula — Information not to be disclosed to other than recipient and other regulatory agencies.)

DATE March 3, 1989

SECTION I. PRODUCT IDENTIFICATION

TRADE NAME	CITRIKLEEN
FORMULA	Para-menthadiene, alkyl aryl sulfonate, diethylene glycol monobutyl ether, alkyl aryl polyether, ethanolmine, EDTA-type chelate, butylated hydroxytolyene, water.
CHEMICAL FAMILY	Liquid Cleaner

SECTION II. HAZARDOUS INGREDIENTS

	COMPONENT OR MATERIAL CHEMICAL NAMES	CAS NO.	OSHA PEL	ACGIH TLV
*	Ethanolamine	141-43-5	3PPM (6 PPM STEL)	3 PPM
*	Diethylene Glycol Monobutyl Ether	112-34-5	N/A	N/A
	* Listed SARA Title III			

SECTION III. PHYSICAL DATA

BOILING POINT (°F): Approximately 212	VAPOR PRESSURE, mm Hg @ 20°C (68°F): Not Determined
EVAPORATION RATE ~~(XXX=XX~~ (acetone=1): 0.08	VAPOR DENSITY (AIR=1) @ 60-90°F: Not Determined
SOLUBILITY IN H_2O, % by wt @ 20°C (68°F): Forms stable emulsion	% VOLATILES by VOL. @ 70°F: ~70
SPECIFIC GRAVITY H_2O = 1 @ 75°F: 0.976	pH: (10% Solution): 10.0
APPEARANCE & ODOR: Clear, light-yellow liquid; citrus-pine odor.	

SECTION IV. FIRE AND EXPLOSION DATA

FLASH POINT (Method Used): 165°F (COC); 125°F (PMCC)	FLAMMABLE EXPLOSIVE LIMITS	Not	UPPER: Not Determined	LOWER: Not Determined
EXTINGUISHING MEDIA: CO2, dry powder, foam type				
SPECIAL FIRE FIGHTING PROCEDURES: Treat as Class B (Oil Type) fire.				
UNUSUAL FIRE & EXPLOSION HAZARDS: None				

SECTION V. EMERGENCY AND FIRST AID PROCEDURES

EYES: Immediately flush with water for several minutes. See physician immediately.
SKIN: Flush with water for several minutes. If irritation develops or persists, consult phys
INHALATION: Remove to fresh air. Perform artificial respiration if needed.
INGESTION

SECTION VI—HEALTH HAZARD DATA

ROUTE(S) OF ENTRY: Eyes	INHALATION X	SKIN X	INGESTION X

HEALTH HAZARDS *(ACUTE AND CHRONIC)* Acute: Corrosive to skin, eyes, mouth, & esophagus on contact.
Inhalation: May cause dizziness & drowsiness & irritation to mucous membrane.
Chronic: Ethanolamine has been linked to liver & kidney damage in animals.

CARCINOGENICITY:	NTP N.A.	IARC MONOGRAPHS N.A.	OSHA REGULATED

SIGNS AND SYMPTOMS OF EXPOSURE
Inhalation - May cause dizziness & drowsiness & irritation to mucous membrane.
Inhalation of high vapor concentrations may cause dizziness & drowsiness.
Skin - Redness or irritation to skin. Eyes - Irritation or stinging sensation.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Cuts and abrasions

EMERGENCY AND FIRST AID PROCEDURES

SEE SECTION V

SECTION VII. REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY	Product is stable
INCOMPATIBILITY	Strong acids.
HAZARDOUS DECOMPOSITION PRODUCTS	None known
CONDITIONS CONTRIBUTING TO POLYMERIZATION	Will not occur

SECTION VIII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	Collect on absorbent material or mop up with water.
NEUTRALIZING CHEMICALS	Not Applicable
WASTE DISPOSAL METHOD	Allow used emulsions to separate, skim off top oil layer and discharge bottom layer in accordance with EPA regulation

SECTION IX. VENTILATION AND PERSONAL PROTECTIVE EQUIPMENT

VENTILATION REQUIREMENTS		Local exhaust recommended in confined areas.
SPECIAL PERSONAL PROTECTIVE EQUIPMENT	RESPIRATORY	Maintain adequate ventilation.
	EYE	Splash proof goggles, if splashing is anticipated.
	GLOVES	Solvent resistant (rubber/neoprene)
	OTHER CLOTHING & EQUIPMENT	Use goggles, apron, boots, as required .

SECTION X. SPECIAL PRECAUTIONS INCLUDING STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING & STORAGE (Always refer to label directions when using.)
Do not re-use container. Dispose of container in accordance with local, state and federal EPA regulations.

D.O.T. SHIPPING CLASSIFICATION
Alkaline Corrosive Liquid, N.O.S. (NA 1719)

APPENDIX J

EMPLOYEE MEDICAL AID

EMPLOYEE MEDICAL AID

Medical Aid - If an employee requires medical aid while on the job, the problem is reported to the on-site supervisor immediately. If adequate medical/first aid is not available on the job, the employee is sent to the company-appointed medical center as per Article VII of Company Policy.

In an emergency situation, aid will be sought at the nearest emergency medical facility available. Employees and their supervisors are instructed to contact Great Lakes Environmental Services as soon as possible after an accident occurs **(24 hours a day) at (313) 758-0400.**
Information to report:

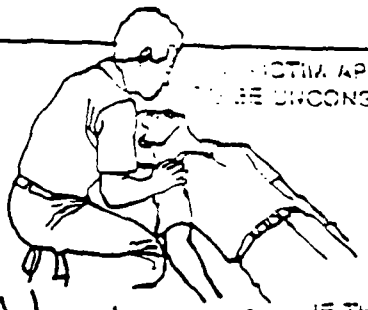
Who was injured

Nature of injury

Name of medical facility rendering aid (phone number, if possible)

Accident Report - As soon as possible (and always prior to resuming work), employees are instructed to complete an employee accident report form. These forms are used to help identify the cause of the accident and help Great Lakes Environmental Services to prevent the same type of accident from happening again. This form must be forwarded to the Great Lakes Environmental Services health and safety department, who will in return forward to the appropriate involved parties.

WHEN BREATHING STOPS



IF VICTIM APPEARS TO BE UNCONSCIOUS

TAP VICTIM ON THE SHOULDER AND SHOUT, "ARE YOU OKAY?"

IF THERE IS NO RESPONSE

TILT THE VICTIM'S HEAD, CHIN POINTING UP. Place one hand under the victim's neck and gently lift. At the same time, push with the other hand on the victim's forehead. This will move the tongue away from the back of the throat to open the airway.

IMMEDIATELY LOOK, LISTEN, AND FEEL FOR AIR.

While maintaining the backward head tilt position, place your cheek and ear close to the victim's mouth and nose. Look for the chest to rise and fall while you listen and feel for the return of air. Check for about 5 seconds.

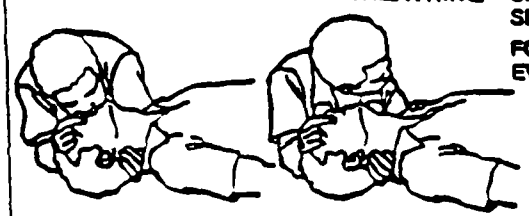
IF THE VICTIM IS NOT BREATHING

GIVE FOUR QUICK BREATHS.

Maintain the backward head tilt, pinch the victim's nose with the hand that is on the victim's forehead to prevent leakage of air, open your mouth wide, take a deep breath, seal your mouth around the victim's mouth, and blow into the victim's mouth with four quick but full breaths just as fast as you can. When blowing, use only enough time between breaths to lift your head slightly for better inhalation. For an infant, give gentle puffs and blow through the mouth and nose and do not tilt the head back as far as for an adult.

If you do not get an air exchange when you blow, it may help to reposition the head and try again.

AGAIN, LOOK, LISTEN, AND FEEL FOR AIR EXCHANGE.

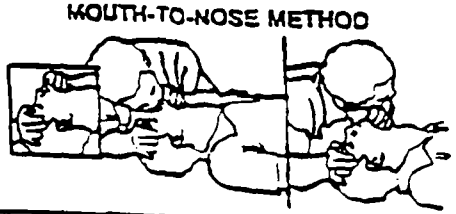


IF THERE IS STILL NO BREATHING

CHANGE RATE TO ONE BREATH EVERY 5 SECONDS FOR AN ADULT.

FOR AN INFANT, GIVE ONE GENTLE PUFF EVERY 3 SECONDS.

MOUTH-TO-NOSE METHOD



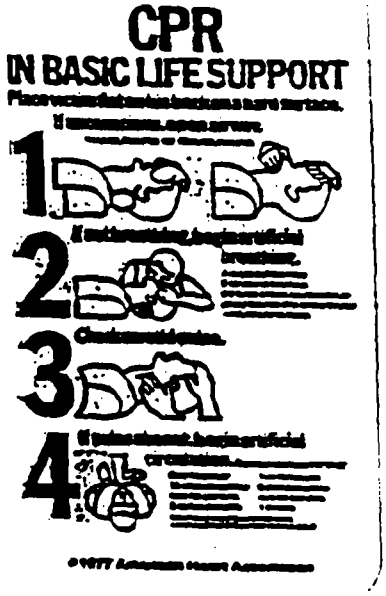
The mouth-to-nose method can be used with the sequence described above instead of the mouth-to-mouth method. Maintain the backward head-tilt position with the hand on the victim's forehead. Remove the hand from under the neck and close the victim's mouth. Blow into the victim's nose. Open the victim's mouth for the look, listen, and feel step.

For more information about these and other life saving techniques, contact your Red Cross chapter for training.

American Red Cross

ARTIFICIAL RESPIRATION

Poster 1002-A
Rev. April 1978



WE'RE FIGHTING FOR
YOUR LIFE

American Heart
Association

National Center
7320 Greenville Avenue • Dallas, Texas 75231

Printed by the American Heart Association's Office of Communications
70-023-E
80-83-4MM
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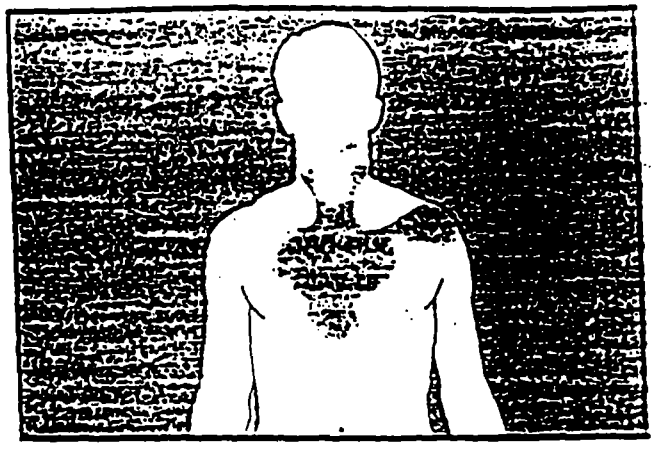
CPR in Basic Life Support for Cardiac Arrest

American Heart
Association



SIGNALS

The most common signal of a heart attack is:

- uncomfortable pressure, squeezing, fullness or pain in the center of the chest behind the breastbone.

Other signals may be:

- sweating
- nausea
- shortness of breath, or
- a feeling of weakness

Sometimes these signals subside and return.

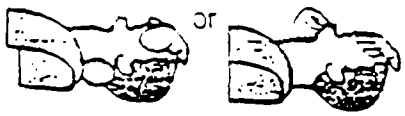
ACTIONS for SURVIVAL

- Recognize the "signals".
- Stop activity and sit or lie down.
- If signals persist 2 minutes or longer, call the emergency number, or if not available, go to the nearest hospital emergency room which provides emergency cardiac care.

There are many causes of sudden death: poisoning, drowning, suffocation, choking, electrocution and smoke inhalation. But the most common cause is heart attack. Everyone should know the usual early signals of heart attack and have an emergency plan of action.

Basic CPR is a simple procedure, as simple as A-B-C, Airway, Breathing and Circulation.

Airway



If you find a collapsed person, determine if the victim is conscious by shaking the shoulder and shouting "Are you all right?" If no response, shout for help. If victim is not lying flat on his back, roll victim over, moving the entire body at one time as a total unit. Then open the airway.

To open the victim's airway, lift up the neck or chin gently with one hand while pushing down on the forehead with the other to tilt head back. Once the airway is open, place your ear close to the victim's mouth:

- Look — at the chest and stomach for movement.
- Listen — for sounds of breathing.
- Feel — for breath on your cheek.

If none of these signs is present, victim is not breathing.

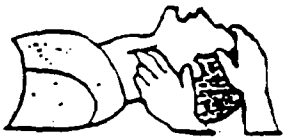
If opening the airway does not cause the victim to begin to breathe spontaneously, you must provide rescue breathing.

Breathing

The best way to provide rescue breathing is by using the mouth-to-mouth technique. Take your hand that is on the victim's forehead and turn it so that you can pinch the victim's nose shut while keeping the heel of the hand in place to maintain head tilt. Your other hand should remain under the victim's neck or chin, lifting up.

Immediately give four quick, full breaths in rapid succession using the mouth-to-mouth method.

Check Pulse



After giving the four quick breaths, locate the victim's carotid pulse to see if the heart is beating. To find the carotid artery, take your hand that is under the victim's neck, or supporting the chin, and locate the voice box. Slide the tips of your index and middle fingers into the groove beside the voice box. Feel for the pulse. Cardiac arrest can be recognized by absent breathing and an absent pulse in the carotid artery in the neck.

If you cannot find the pulse, you must provide artificial circulation in addition to rescue breathing. **Activate The Emergency Medical Services System (EMSS). Send someone to call 911 or your local emergency number.**

External Chest Compression

Artificial circulation is provided by external chest compression. In effect, when you apply rhythmic pressure on the lower half of the victim's breastbone, you are forcing his heart to pump blood. To perform external chest compression properly, kneel at the victim's side near his chest. Locate the notch at the lowest portion of the sternum. Place the heel of one hand on the sternum next to the fingers that located the notch. Place your other hand on top of the one that is in position. Be sure to keep your fingers off the chest wall. You may find it easier to do this if you interlock your fingers.

Bring your shoulders directly over the victim's sternum as you compress downward, keeping your arms straight. Depress the sternum about 1½ to 2 inches for an adult victim. Then relax pressure on the sternum completely. However, do not remove your hands from the victim's sternum, but do allow the chest to return

to its normal position between compressions. Relaxation and compression should be of equal duration.

If you are the only rescuer, you must provide both rescue breathing and external chest compression. The proper ratio is 15 chest compressions to 2 quick breaths. You must compress at the rate of 80 times per minute when you are working alone since you will stop compressions when you take time to breathe.

When there is another rescuer to help you, position yourselves on opposite sides of the victim if possible. One of you should be responsible for interposing a breath during the relaxation after each fifth compression. The other rescuer, who compresses the chest, should use a rate of 60 compressions per minute.

RESCUERS	RATIO OF COMPRESSIONS TO BREATHS	RATE OF COMPRESSIONS
ONE	15:2	80 times/min.
TWO	5:1	60 times/min.

For Infants (Birth to 1 year) and Children (1 year to 8 years)

Basic life support for infants and children is similar to that for adults. A few important differences to remember are given below.

Airway

Be careful when handling an infant that you do not exaggerate the backward position of the head tilt. An infant's neck is so pliable that forceful backward tilting might block breathing passages instead of opening them.

Breathing

Don't try to pinch off the nose. Cover both the mouth and nose of an infant who is not breathing. Use small breaths with less volume to inflate the lungs. Give one small breath every three seconds. If the victim is a child, cover the mouth and breathe every four seconds.

Check Pulse

In an infant, the absence of a pulse may be more easily determined by feeling on the inside of the upper arm midway between the elbow and the shoulder. The pulse check in the child is the same as the adult.

Circulation

The technique for external chest compression is different for infants and small children. In both cases, only one hand is used for compression. The other hand may be slipped under the infant to provide a firm support for his back.

For infants, use only the tips of the index and middle fingers to compress the chest at mid-sternum. Depress the sternum between ½ to 1 inch at a rate of 100 times a minute.

For children, use only the heel of one hand to compress the chest. Depress the sternum between 1 and 1½ inches, depending upon the size of the child. The rate should be 80 times per minute.

In the case of both infants and children, breaths should be administered during the relaxation after every fifth chest compression.

	Part of Hand	Hand Position	Depress Sternum	Rate of Compression
INFANTS	tips of index and middle fingers	mid-sternum	½ to 1 inch	100 per minute.
CHILDREN	heel of hand	mid-sternum	1 to 1½ inches	80 per minute

Neck Injury

If you suspect the victim has suffered a neck injury, you must not open the airway in the usual manner. If the victim is injured in a diving or automobile accident, you should consider the possibility of such a neck injury. In these cases, the airway should be opened by using a modified jaw thrust, keeping the victim's head in a fixed, neutral position.

Other conditions which may cause unconsciousness and airway obstruction include: stroke, epilepsy, head injury, alcoholic intoxication, drug overdose, diabetes.

REMEMBER

1. Is the victim unconscious?
2. If so, shout for help, open the airway, and check for breathing.
3. If no breathing, give 4 quick breaths.
4. Check carotid pulse.
5. Activate the EMSS: Send someone to call "911" or your local emergency number.
6. If no pulse, begin external chest compression by depressing lower half of the sternum 1½ to 2 inches.
7. Continue uninterrupted CPR until advanced life support is available.

CPR for ONE RESCUER: 15:2 compressions to breaths at a rate of 80 compressions a minute (4 cycles per minute)

CPR for TWO RESCUERS: 5:1 compressions to breaths at a rate of 60 compressions a minute

Periodic practice in CPR is essential to insure a satisfactory level of proficiency. A life may depend upon how well you have remembered the proper steps of CPR and how to apply them. You should be sure to have tested both your skill and knowledge of CPR at least once a year. It could mean someone's life.

Emergency Medical Service Telephone Numbers:

Home: _____

Work: _____

Emergency Medical Services System (EMSS)

Any victim on whom you begin resuscitation must be considered to need advanced life support. He or she will have the best chance of surviving if your community has a total emergency medical services system. This includes an efficient communications alert system, such as 911, with public awareness of how or where to call; well trained rescue personnel who can respond rapidly; vehicles that are properly equipped; an emergency facility that is open 24 hours a day to provide advanced life support; and an intensive care section in the hospital for the victims. You should work with all interested agencies to achieve such a system.

Choking

The urgency of choking, its prevention and first aid steps for infants, children and adults cannot be over-emphasized. For more information contact your Heart Association.

For a Healthier Heart

- Have your blood pressure checked regularly.
- Don't smoke cigarettes.
- Eat foods low in saturated (animal) fats and cholesterol.
- Maintain proper weight.
- Exercise regularly.
- Have regular medical check-ups.

Prepared by the
Committee on Emergency Cardiac Care.

IF YOU CANNOT GET IMMEDIATE HELP, THE FOLLOWING SAFETY MEASURES MAY PROVIDE EMERGENCY RELIEF.

In All Cases except poisonous bites, the principle is GET THE POISON OUT or OFF or DILUTE it. CALL PROMPTLY FOR EMERGENCY HELP.

Swallowed Poison: Give a glass of water or milk. Then call the poison control center, doctor, or hospital emergency room for further instructions.

- If advised to induce vomiting, administer syrup of ipecac (available from most drug stores) as directed.
- Get the victim to medical help. Take any vomit material and the poison container with you.

BUT NOT IF

— patient is unconscious or having seizures.

— swallowed poison was a strong corrosive (lye, strong acid, drain cleaner, etc.)

— swallowed poison contains kerosene, gasoline or other petroleum distillates (unless containing a dangerous pesticide or chemical which must be removed).

To Induce Vomiting: Give one tablespoonful (1/2 ounce) of syrup of ipecac for a child one year of age or older, plus at least one cup of water. *Never substitute carbonated fluids.* If no vomiting occurs in 20 minutes, this dose may be repeated once only. After vomiting has ceased, offer a slurry of activated charcoal (2-4 tablespoonfuls) in a glass of water.

- If no ipecac syrup is available, try to induce vomiting by tickling back of throat with a spoon handle or other blunt object, after giving water.
- *Do not* give salt or mustard to children.
- *Do not* waste time waiting for vomiting, but transport patient promptly to a medical facility. Bring package or container with intact label.

Inhalation Poisoning (Gas, Fumes, Smoke)

- Get into fresh clean air.
- Loosen clothing.
- If not breathing, start artificial respiration promptly. Do not stop until breathing or help arrives.
- Have someone else call for emergency help and transport to a medical facility promptly.

Bites

Snakes: Keep the person calm and quiet.

- Immobilize the bitten extremity and keep it at or below the level of the heart.
- If mild or moderate symptoms (mild swelling and/or pain, general weakness, nausea, shortness of breath) develop, apply a constricting band, not a tourniquet and not tight enough to cut off circulation. Fashion with any available cloth or tie. You should be able to slip a finger under the band.
- (NOTE: Suction will not be of much value unless incisions are made over the bite marks. Such incisions are *not* recommended unless medical help is not available for several hours or severe symptoms develop.)

Insects: Do not let victim walk, keep as quiet as possible.

- Place any available cold substance on bite area to relieve pain.
- A paste of Adolph's Meat Tenderizer or Baking Soda and water applied to the bite will often reduce the swelling and itching by its enzymatic action.
- If victim stops breathing, use artificial respiration.
- Call for emergency help and transport to a medical facility. (Persons with known unusual reactions to insect stings should carry emergency treatment kits and an emergency identity card).

Human: Wash thoroughly with soap and water.

- Call physician for a severe bite.

Bleeding (Severe): Call for emergency help and transport to a medical facility.

- *Do not* use any antiseptics or other materials.
- Place a thick pad of clean cloth or bandage directly over wound and press firmly to control blood flow.
- Hold in place with strong bandage, necktie, cloth strips, or hand.
- *Do not* make the tie so tight as to prevent circulation to the rest of the limb.
- In case of injuries to the groin, armpit, or neck, where ties cannot be used, control blood flow with finger or hand pressure.
- Raise the bleeding part higher than the rest of the body, unless, bones are broken.
- If injury is extensive, treat for shock.

Nosebleeds: Put the person in a sitting position, leaning forward.

- With a finger against the bleeding nostril, apply firm pressure for five minutes.
- Apply cold compresses to face and nose.
- If bleeding continues, get medical help.

Broken Bones: If a fracture of any part of the body or any injury to the head, neck or back is suspected, the *patient should not be moved* without medical supervision unless absolutely necessary.

- If a patient with a back or neck injury must be moved, keep the back, head and neck in a straight line, preventing them from being twisted or bent during movement. Use a board to help keep back, neck and head rigid.
- For other fractures, until you get medical help, place the injured part in as natural a position as possible without causing discomfort to the patient.
- Protect from further injury by applying splints long enough to extend well beyond the joints above and below the fracture. Any firm material can be used (board, pole, metal rod, or even a thick magazine or thick folded newspaper). Pad splints with clothing or other soft material to prevent skin injury. Fasten with bandage or cloth at the break and beyond joints above and below it. Use pressure bandage to control bleeding. (See Bleeding).

Burns and Scalds: Minor burns may be immersed in cold water. Severe burns should be covered with dry, clean material to exclude air.

- Get medical attention.
- If he is conscious and can swallow, give plenty of water or other *non-alcoholic liquids* to drink.
- *Do not* use ointments, greases, powder, etc.
- Until you get medical help, immerse burned area immediately in cold water or apply clean, cold, moist towels.
- Chill water with ice, if possible, but never add salt.
- Maintain treatment as long as pain or burning exists. In case of chemical burns, flush skin with plenty of running water.
- Cover burned area with clean cloth to exclude air.
- Avoid breaking any blisters that may appear.

If burns are extensive, keep patient quiet and treat for shock.

Choking: If the victim is conscious and cannot cough, speak, or breathe — give four back blows (between the shoulder blades), followed by four abdominal thrusts for adults, four chest thrusts for infants and children.

- For infants, the chest thrusts are delivered with two fingers over the breastbone between the nipples. The baby's head should be lower than the chest for back blows and thrusts. For the child, chest thrusts are given with the heel of one hand over the breastbone (the child should be lying down).

Convulsions: If caused by fever, sponge body with cool water.

- Apply cold cloths to head.
- Lay on side with hips elevated.
- Prevent biting of tongue by using rolled-up handkerchief.
- Be sure tongue is not blocking passage of air to the lung.
- Call physician.

Eye Contamination: Remove contact lenses if worn; *never* permit the eye to be rubbed.

- Flush the affected eye from the inside corner for at least five minutes.
- Call for emergency help and transport to a medical facility promptly.

Fainting: Keep in flat position.

- Elevate legs and feet.
- Loosen clothing around neck.
- Keep patient warm—if necessary.
- Keep mouth clear.
- Give nothing to swallow.
- If breathing has stopped, start Artificial Respiration. (see below)
- Have someone call for emergency help and transport to a medical facility if fainting is prolonged.

Shock: Shock usually accompanies severe injury or emotional upset. The signs are cold and clammy skin, pale face, chills, frequent nausea or vomiting, shallow breathing.

- Call for emergency help and treatment.
- Keep the person lying down.
- May elevate the feet if the face is pale and there are no head or chest injuries.
- If the face is flushed or there are head and/or chest injuries, raise the head and shoulders.

Artificial Respiration: There is need for help in breathing when breathing movements stop or lips, tongue and fingernails become blue. *When in doubt, apply artificial respiration* until you get medical help. No harm can result from its use, and delay may cost the patient his life. Start immediately. Seconds count.

- Lift the neck gently, tilt head back. Put your cheek and ear close to the victim's mouth and nose; look, listen, and feel for breathing.
- If no breathing, place your mouth over the victim's mouth, pinch the nostrils, and give four quick, full breaths.
- Check again for breathing, and check for a pulse (on the side of the neck).
- If there is a pulse but no breathing, give one breath every five seconds for adults. Remove your mouth between breaths so the victim can exhale.
- If there is no pulse and no breathing, give CPR (cardiopulmonary resuscitation) if trained to do so. Send someone for help as soon as possible.

For Infants: Give one puff of air every 3 seconds.

In Case of Serious Injury or Illness:
Call your emergency medical services (rescue squad or ambulance), doctor, or hospital service immediately. Keep calm, briefly explain what has happened and ask what to do until help arrives.

Our thanks to Dr. Jay M. Arena, Professor of Pediatrics at Duke University Medical Center, for permission to reproduce this first aid chart for parents. Basic first aid principles are to be used in an emergency until professional help can be obtained or consulted.

EMERGENCY TELEPHONE NUMBERS

Doctor _____
Poison Control Center _____
Ambulance/Rescue Squad _____
Hospital _____
Police _____
Fire Dept. _____
Pharmacist _____
Dentist _____
Neighbor _____

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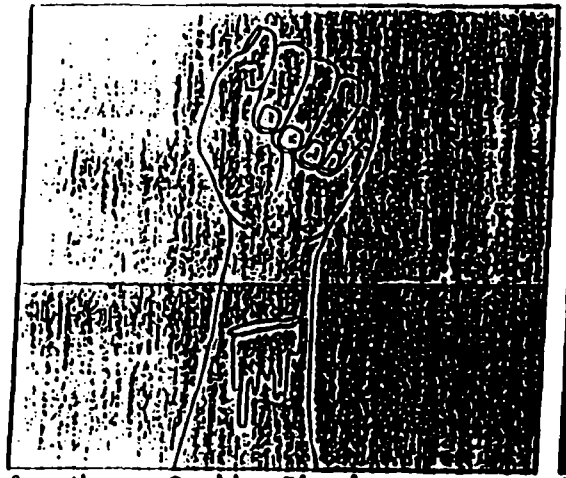
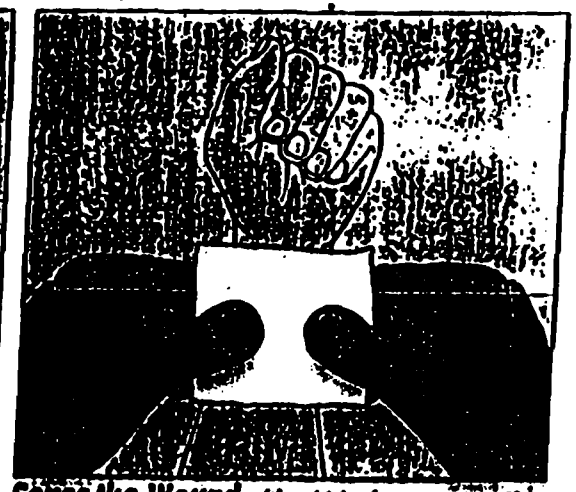
HOW TO STOP SEVERE BLEEDING



Spurting or Gushing Blood can cause death in minutes. You can save the life of a bleeding person by *acting quickly.*



Cover the Wound with a thick, clean compress. If you do not have a handkerchief or piece of clothing, use your hand.

Press Hard and Elevate the wound above the heart. Don't elevate if movement causes pain.

Send for Emergency Help. Send someone else so you can stay with the victim.

What To Do In an Emergency

Help the Victim

1. **Rescue the Victim** from life-threatening danger, if necessary.

2. **Send Someone** to seek medical help, if the injury or illness is serious.

3. **Restore or Maintain Breathing and Heartbeat** using *mouth-to-mouth resuscitation or CPR.*

4. ***Control Heavy Bleeding*** by applying a clean compress and firm, direct pressure to the wound.

5. **Treat Poisoning** as directed by the Poison Control Center. Save any container and try to identify the poison before calling the Center.

6. **Prevent Shock** by helping the victim to lie down and by maintaining body temperature.

7. **Examine the Victim** for other injuries.

8. **Seek Medical Help.** Call 911, if not done previously. *Arrange follow-up medical care.*

9. ***Keep Checking*** the victim's *breathing and pulse. Don't* leave until medical help arrives.

Get Emergency Medical Help Fast

While one person *administers first aid or CPR* to the victim another must seek medical help.

Dial 911 or the emergency number for your area. Be ready to answer questions and provide important information:

Location of the Emergency, including cross streets, floor *and room numbers,* and the phone number from which you are calling.

What Happened? What kind of accident, injury or illness occurred?

How Many People Need Help? Is anyone bleeding or unconscious? What first aid has been administered?

Don't Hang Up First! Be sure you have provided all necessary information.

Training in first aid and CPR can save a life. Learn it BEFORE you need it by contacting your Red Cross chapter.

FIRST AID
[illegible]
TEARS

EMPLOYEE ACCIDENT REPORT FORM

DATE: _____

COMPANY NAME: _____

EMPLOYEE NAME: _____ POSITION: _____

JOB NAME: _____

DATE OF ACCIDENT: _____ TIME OF ACCIDENT: _____

LOCATION WHERE ACCIDENT OCCURRED: _____

_____

_____

WRITE IN YOUR OWN WORDS WHAT HAPPENED? (EQUIPMENT INVOLVED, ETC): _____

_____

_____

DESCRIBE THE NATURE OF YOUR INJURY: _____

_____

_____

_____

DESCRIBE ANY TREATMENT RECEIVED FOR INJURY: _____

_____

WHAT COULD HAVE BEEN DONE TO AVOID THE INJURY OR TO AVOID SIMILAR INJURIES IN THE FUTURE? _____

_____

_____

EMPLOYEE SIGNATURE: _____ DATE: _____

SUPERVISOR TO INTERVIEW EMPLOYEE AND COMPLETE SUPERVISOR REPORT FORM